PowerWAVE 1000

4.5 kVA to 10 kVA Single Phase Models
User Manual

Uninterruptible Power Supplies Ltd
A KOHLER COMPANY

Document Control

ISSUE	DATE	REVISION SUMMARY
725-02-00	05/08/14	Manual revised and issued as 725-02-00
725-02-01	03/11/14	Updated rack mounting procedure
725-02-02	13/03/15	Updated front cover to show Single Phase Output UPS

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1 Safety

1.1 Description of the safety symbols used in this manual

WARNING: The warning symbol is used where there is danger of an electrical shock, equipment damage or personal-injury.

CAUTION: *The caution symbol is used to highlight important information to avoid possible equipment malfunction or damage.*

1.2 User precautions

WARNING: Ensure you read and understand all the safety and hazard warnings contained in this manual before you begin to install this equipment.

WARNING: Keep this manual with the UPS for future reference.

WARNING: The UPS and peripheral equipment must be installed by a suitably qualified engineer who is aware of the potential shock hazards.

WARNING: Before it is put into service, this UPS must be set-up and commissioned by a suitably qualified engineer in accordance with the procedures contained in Chapter 3.

WARNING: This UPS does not contain any user-serviceable parts. If the UPS develops a fault it must be repaired by a trained engineer.
You run risk of exposure to dangerous voltages if you open UPS-covers!
Uninterruptible Power Supplies Ltd will assume no responsibility or liability for accidents or injuries due to incorrect operation or manipulation of the UPS or peripheral equipment.

CAUTION: *The PowerWave 1000 is a Class A UPS product (according to EN 62040-3).*
In a domestic environment the UPS may cause radio interference and the user may be required to undertake additional measures.

1.3 Important safety notes

CAUTION: *Please read the following notes carefully prior to installation.*

Although the PowerWave 1000 UPS was designed for simple installation, it must be installed by a suitably qualified service specialist. The UPS does not contain any user-serviceable parts, so if it malfunctions it must be serviced or repaired by a trained engineer.

The UPS is equipped with an electromagnetic interference filter (EMI). It must be properly earthed at all times in order to prevent excessive leakage currents.

To prevent the UPS from overheating, the UPS ventilation louvres on the UPS front panel must be kept free of obstructions at all times. A space of at least 30 cm (12 in) should be provided at the back of the UPS to allow adequate airflow from the ventilation fans.

The UPS is must be installed in a sheltered and controlled environment away from direct sunlight. The operating temperature should be between 0-40°C with relative humidity of 30-90%, non-condensing.

Before installing the equipment you must check to ensure that the UPS input voltage stated on the UPS data-plate on the back of the unit matches your local utility supply voltage.

The UPS warranty will be rendered void, and the manufacturer reserves the right to refuse replacement or compensation in the following events:

- Accidental damage to the UPS.
- Ingress of liquids or foreign bodies.
- Damage or malfunction due to installing the UPS in an environment that fail to meet the conditions specified in this manual.
- Damage or malfunction due to improper installation, configuration or maintenance carried out by an unauthorised person.

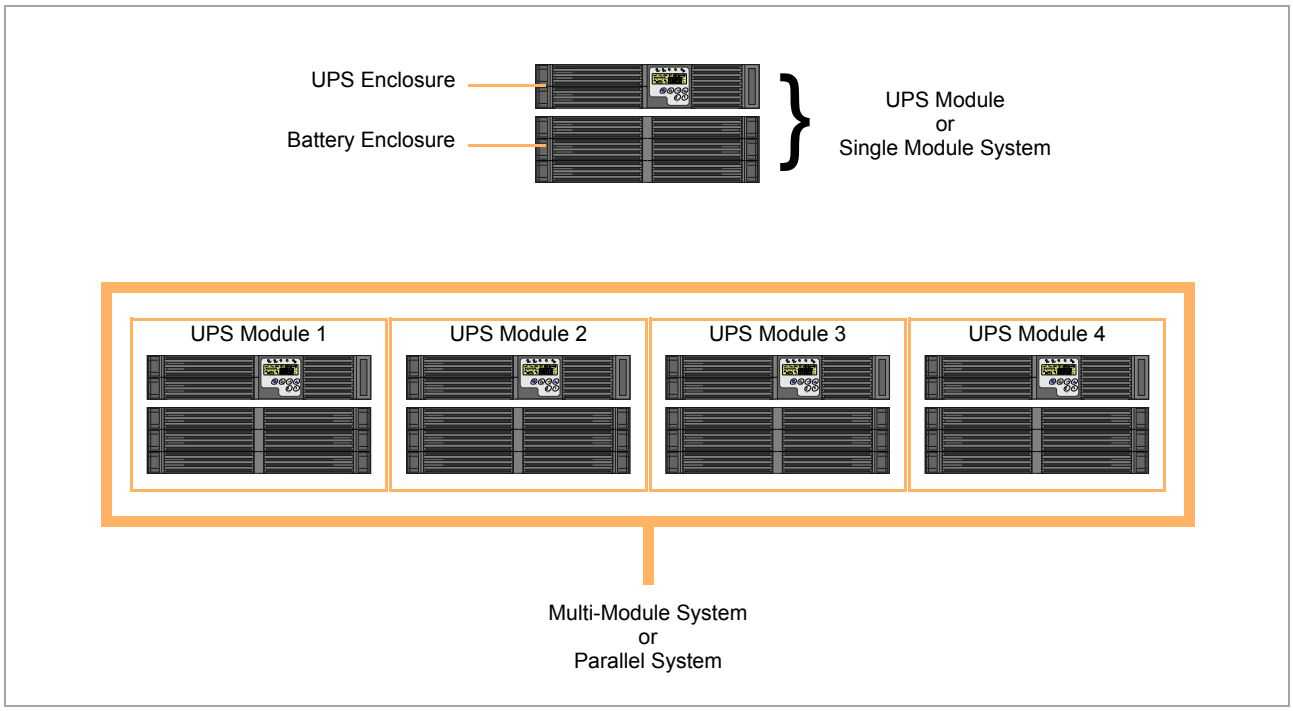
1.4 Storage instructions

If you intend to store the UPS for an extended period, in a moderate climate, the batteries should be charged for 12 hours every 3 months by connecting the UPS to the utility supply. If the ambient temperature at the storage location is above 30°C, this should be carried out every 2 months.

CAUTION: *Always switch off the UPS before moving it.*

1.5 Terminology

The following terms are used in this manual to described the UPS system components.



2 General Description

2.1 Introduction

Congratulations on your purchase of the PowerWave 1000 UPS.

High reliability, low operating cost and excellent electrical performance are just some of the highlights of this innovative UPS solution.

By employing the latest technological developments in power engineering, the PowerWave 1000 represents a new generation of transformerless UPS-System. Its advanced double conversion Voltage and Frequency Independent (VFI) topology responds fully to both the highest availability, and environmentally friendly requirements, compliant with IEC 62040-3 (VFI-SS-111) standards. A full UPS specification is shown in chapter 9 of this manual.

Uninterruptible Power Supplies Ltd specialises in the installation and maintenance of Uninterruptible Power Systems; and this powerful UPS is just one example of our wide range of state-of-the-art power protection devices that will provide your critical equipment with a steady and reliable power supply for many years to come.

The PowerWave 1000 key features include:

- High-frequency transformerless technology with a rack/tower-compatible enclosure which permits the integration of the UPS even under the most challenging space constraints.
- Up to four PowerWave 1000 UPS modules can be configured to operate as a parallel system, with designed module redundancy to further enhance the overall system reliability.
- 'OFF LINE' (ECO) operating mode is available to reduce running costs of suitable applications.
- User friendly design that permits simple and trouble-free installation.
- The use of maintenance-free batteries reduces the need for after-sales service.
- True on-line technology continuously supplies your critical applications with stable, regulated, transient-free, pure sine-wave AC power.
- Highly efficient PWM sine-wave technology yields excellent UPS efficiency. The high crest factor of the inverter means that it can handle loads with peak inrush current characteristics and so avoids a need to upgrade to a UPS with a higher power rating.
- Compliance with stringent international standards for electromagnetic interference & protection.
- Inbuilt frequency changer capabilities that can be selected for 50/60 Hz or 60/50 Hz input/output frequency operation (single module installation only).
- Fully digitized control logic for better functionality and high quality output power supply. Digital signal processing (DSP) also provides an efficient communication capability that facilitates flexible remote control and monitoring options.
- An active input power factor correction (PFC) control function that produces in an input power factor (PF) of +0.99, resulting in outstanding energy efficiency.
- Operation over a wide range of input voltages. The UPS will operate normally with a utility supply of 160V~288V without draining the battery – which extends the battery service life.
- A DC-start function permits the UPS to be started during a utility power failure if required.
- A revolutionary battery management circuit continuously analyses the battery status during discharge and adjusts the battery cut-off point accordingly – which once again maximises the battery service life.
- A selectable bypass voltage tolerance (low/high sensitivity) can be used to restrict the range of voltages that can be applied to the load when the UPS operates on bypass.
  The selectable voltage ranges are 184V~260V (low sensitivity) and 194V~260V (high sensitivity).

- A range of UPS output voltages (200/208/220/230/240V) can be selected to suit the local supply or specific load voltage requirements.
- An overload detection system automatically switches the UPS output from its inverter to an internal bypass in the event of an overload that exceeds the rated inverter capacity; and automatically switches back to the inverter mode once the overload condition clears.
- An output short-circuit detection circuit turns off the UPS and disconnects its output supply until the cause of the short circuit is manually remedied.

2.2 PowerWave 1000 Model range

		PW1000/4.5	PW1000/6.0	PW1000/8.0	PW1000/10.0
Maximum output power	kVA (kW)	4.5 (4.05)	6.0 (5.4)	8.0 (7.2)	10.0 (9.0)
Dimensions (with batteries) (WxHxD)	mm	222 x 445 x 680	222 x 445 x 680	267 x 445 x 680	267 x 445 x 680
19" rack mounting space		(2U+3U) x 680	(2U+3U) x 680	(3U+3U) x 680	(3U+3U) x 680
Weight (with standard batteries)	kg	85	85	92	92
Sound level	dBA	50	50	50	50

The PowerWave 1000 UPS range compromises 4.5 kVA, 6 kVA, 8kVA and 10 kVA models, each of which comprises two matching enclosures. The main UPS enclosure contains the major UPS power components, including a rectifier, battery charger, inverter and static switch; and the second enclosure contains the UPS battery pack.

The enclosures can be configured as a floor-standing tower unit, or installed in a standard 19" rack. An accessory pack containing all the parts necessary to prepare the enclosures for either type of installation is supplied with the UPS.

When installed as a tower system, the UPS and battery enclosures are mechanically attached together to form a single unit. For 19" rack mounting it is usual to fit the UPS system near the bottom of a rack with the UPS enclosure mounted immediately above the battery enclosure – see chapter 3 (Installation) for mechanical configuration details.

Optional equipment, designed to enhance the overall UPS installation, include a matching extended battery enclosure, an external (maintenance) bypass enclosure and an isolation transformer.

The PowerWave 1000 UPS module can be operated as a stand-alone UPS, or up to four modules can be connected in parallel and configured to operate as a multi-module UPS system. A multi-module configuration is generally chosen either to increase a system's total output power capacity or to increase the system's overall reliability by providing module redundancy.

In this manual the terms 'multi-module system' and 'parallel system' are synonymous.

Key Point: All the UPS modules connected to a parallel system must be of the same model type and power rating.

2.3 Functional description of operation

This section describes:

- The internal operation of an individual UPS module (see paragraph 2.3.1).
- The UPS operational modes (see paragraph 2.3.2).
- Multi-module system operation and paralleling considerations (see paragraph 2.3.3).

2.3.1 UPS Internal operation

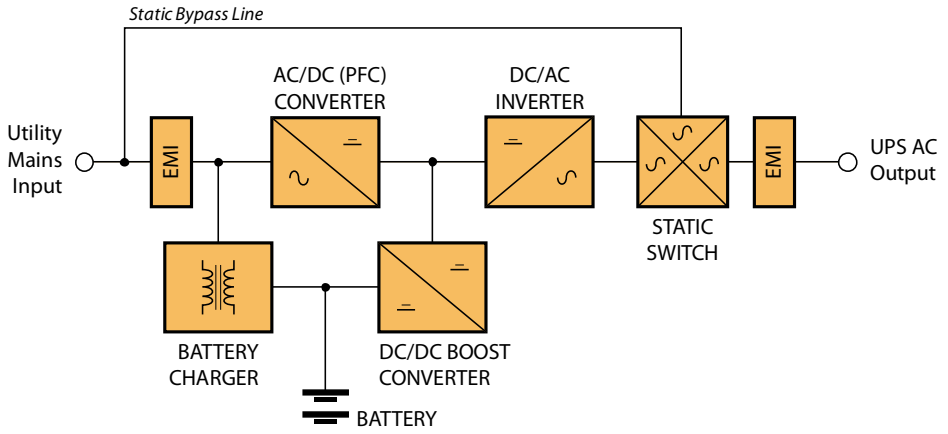


Figure 2.1 UPS Functional block diagram

EMI Filters

The UPS has an input and output EMI filter to reduce the effects of any electromagnetic noise generated by the UPS – i.e. reduces external radio interference.

Battery charger

A multi-stage battery charger is powered from the utility mains input supply and charges the battery whenever the input supply is available. The charger uses an intelligent charging profile to obtain the best battery charge/discharge performance and thereby optimise the battery life.

AC/DC Converter

As its name suggests, the AC/DC Converter converts the utility mains input into a controlled DC power supply that is suitable for use by the inverter. The converter uses leading-edge switched-mode techniques which produces an input power factor of almost unity over its operating range (0.99 at full rated linear load) and thereby maximises the UPS input efficiency. The converter can satisfy the inverter DC power demands over a utility input voltage range of between 160V~288V, which means that the battery is not called upon even during substantial power dips (brownouts), once again maximising battery life and availability.

DC/DC Boost converter

In times of utility mains failure, the AC/DC converter shuts down and it is no longer able to power the inverter. Under these circumstances, the inverter input power is provided by the battery via the DC/DC boost converter, which now turns on to increase the battery voltage to the level that required by the inverter to continue its normal operation. The DC/DC converter provides a regulated DC output as the battery voltage decays during battery discharge, and includes voltage and current monitoring, and overload protection.

DC/AC Inverter

The inverter converts the DC input voltage connected to its input (from either the utility mains supply via the AC/DC converter, or from the battery via the DC/DC converter) into a regulated AC output voltage suitable to power the connected load equipment. The control logic associated with this power block is substantial, and in addition to the output voltage regulation, it provides various levels of overload protection, frequency regulation and synchronisation, and output voltage error detection.

Static switch

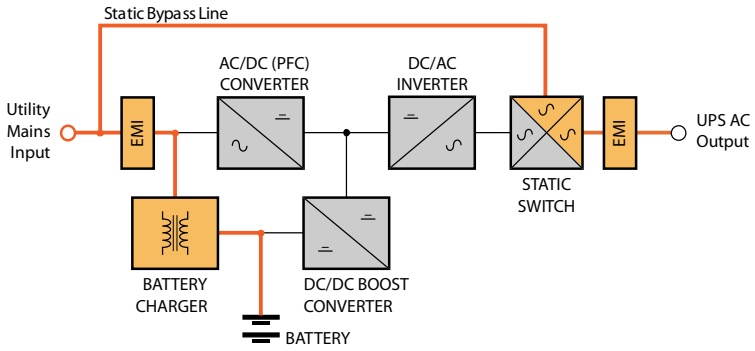
The static switch provides a means of connecting the UPS AC output (load supply) to either the inverter or to a static bypass line, which is connected directly to the raw utility mains supply. The control logic within this power block will transfer the load to the bypass supply in the event of overload or UPS (inverter) malfunction. Note that a controlled (no-break) transfer can take place only if the inverter output frequency and the static bypass line frequency are fully synchronised.

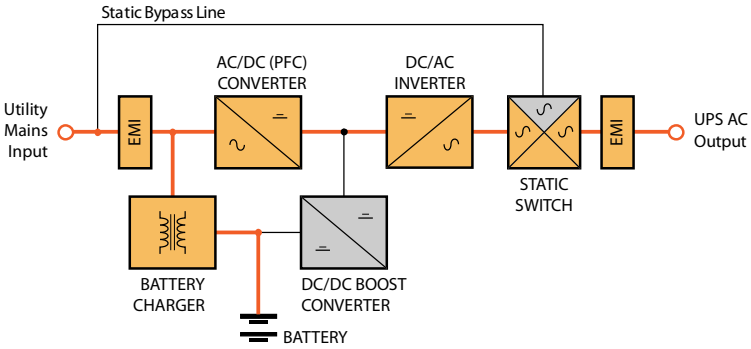
2.3.2 UPS Module operating modes

UPS OFF

This is the state of the UPS when it is turned off from the operator control panel – it is effectively running in bypass mode. It also applies if the UPS locks out due to a fault:

- If the utility supply is still available, the battery charger will be live and maintain the battery charging.
- UPS output has raw mains available.





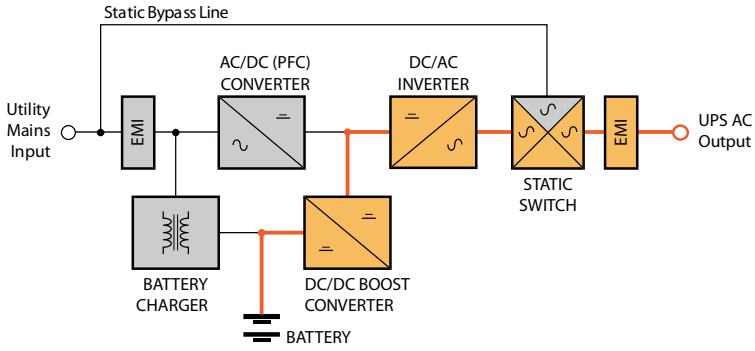
UPS ON-LINE Mode

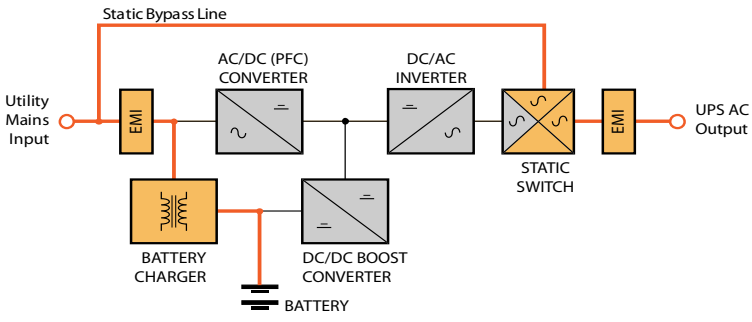
This is the UPS normal mode of operation:
The battery charger charges the battery.
The AC/DC converter processes the utility mains input and turns it into controlled DC power for the inverter input.
The inverter converts the DC supplied by the AC/DC converter back into AC suitable for connecting to the load.
The static switch connects the inverter output to the UPS output (load) terminals.

UPS ON-BATTERY Mode

This is the UPS mode of operation if the utility input fails during normal (ON-LINE) operation:

The battery discharges through the DC/DC boost converter which provides the DC power for the inverter input.
The Inverter convert the DC supplied by the DC/DC boost converter back into AC suitable for connecting to the load.
The static switch connects the inverter output to the UPS output (load) terminals.





UPS ON-BYPASS Mode

This is the 'normal' mode of operation if the UPS is used in its ECO mode, otherwise this mode is usually entered if the UPS has a fault or overload:

The battery is permanently charged as long as the battery charger is still serviceable and able to operate. (If the bypass transfer was due to a UPS fault the battery charger might also have shut down.)
The static switch connects the UPS output (load) terminals directly to the raw utility mains via the static bypass line.

Figure 2.2 Summary of UPS module operating modes

Paragraph 2.3.1 described the internal operation of an individual UPS module. However, as an operational unit the UPS can be described as being in one of four modes – UPS OFF, ON-LINE, ON-BATTERY and ON-BYPASS – as illustrated in Figure 2.2.

UPS systems are generally categorised as being either 'On-line' or 'Off-line' systems, and you can configure the PowerWave 1000 to operate in either one. The difference between the two types of system are described below.

On-line UPS system operation

When used as an 'on-line' UPS the PowerWave 1000 is configured to normally operate in the ON-LINE mode, as shown in Figure 2.2. In the event of a utility supply failure the UPS changes to its ON-BATTERY mode without affecting the UPS output supply – i.e the changeover is totally transparent at the UPS output. The UPS then continues to provide its rated output until the battery discharges to a low cut-off point, at which time the UPS will shut down in a controlled manner. An alarm will warn that the battery is discharging to enable the operator to take any necessary intervention to protect the load integrity.

During ON-LINE operation if the UPS experiences an inverter fault or overload condition the static switch transfers the load to the static bypass line (ON-BYPASS mode) automatically and without interruption (transfer time = 0) provided the inverter and bypass supplies are synchronised.

If the transfer is due to a UPS overload the static switch will transfer the load back to the inverter if the overload clears, and the UPS will return to its normal ON-LINE mode of operation.

This system provides the highest degree of load protection, especially in the event of a utility mains disturbance or complete failure; and we always recommended its use if the critical load (e.g. computer system) will not tolerate even very brief supply interruption.

Off-line operation (single module installation only)

When the PowerWave 1000 is used as an 'off-line' UPS it is normally operated in its ON BYPASS mode (Figure 2.2), with the load supplied via the static bypass line. However the AC/DC converter and battery charger are still powered up and maintain battery charging, and the inverter section is turned on and operating on standby.

In the event of a static bypass supply error, the inverter is immediately brought on line and the load is transferred from the static bypass to the inverter by the static switch within 3 to 5 milliseconds – so the UPS is now operating in its ON-LINE mode. If the utility mains supply is unavailable when the transfer takes place, the UPS inverter will support the load operating from its battery power (i.e. ON-BATTERY mode).

When the static bypass supply returns to normal, the load is re transferred back to the static bypass line and the inverter returns to its standby operation.

Operating in this mode is slightly more energy efficient than operating in the on-line mode due to the reduced AC/DC converter and inverter losses during normal system operation; and it is sometimes referred to as the "ECO" (economy) mode. However this mode is recommended only if the connected load equipment can tolerate power interruptions of up to 3~5 ms during the transfer period.

WARNING: The on-line mode should always be used for critical load protection.

Frequency changer operation (single module installation only)

In addition to the more normal on-line and off-line system operation, the PowerWave 1000 can also be used in a 'frequency changer' mode where the inverter output is produced at a different frequency to that of the utility supply – for example 50 Hz utility mains input with 60 Hz UPS output, or vice versa.

When operating in this mode it is clearly not possible to switch the load between the inverter and bypass, so the bypass side of the static switch is electronically disabled by the UPS control logic, which means that the static bypass line is not available to assist clearing an overload. For this reason it is recommended that the UPS is operated to a maximum 75% load capacity if the input voltage is 176~280 VAC and 50% if the input voltage range is set to 160-280 Vac.

2.3.3 Parallel system operation

Up to four PowerWave 1000 UPS modules can be connected in parallel for increased power capacity or redundancy operation. A functional block diagram of a three module parallel system is shown in Figure 2.3.

A PowerWave 1000 UPS parallel system has a decentralised bypass architecture in that each UPS module contains its own static switch and static bypass line. This eliminates the need for a separate bypass cabinet (as required by some manufacturers' systems) and so avoids a potential single point of failure.

In a multi-module parallel system, the topology and internal operation of each UPS module is identical to that described previously for a stand-alone system. However, when operating as part of a parallel system it is critical that UPS control functions such as load sharing, frequency synchronisation, and load transfer between UPS and bypass, are observed by all the connected modules. In the PowerWave 1000 UPS system the 'inter-module' control functions are achieved using a parallel control bus which takes the form of a ring network connected to all the modules in the system that allows the modules to communicated with each other to properly share their control operation.

When a parallel system is installed, each module is assigned a numerical position within the parallel ring and the 'first' module is deemed to be the 'master' from which the other modules take their lead. If the 'master' module undergoes a problem, or is shut down, the next highest available module in the ring will take over the 'master' role. This avoids a potential single point of failure in the parallel chain and ensures the highest level of power availability.

Parallel system capacity expansion

Some applications present a low initial power demand which increases over time as the application grows; and it is essential that the installed system can be expanded to meet the growing needs without compromising the existing load. This situation is easily managed in a PowerWave 1000 parallel system installation which allows an additional module to be connected to an existing parallel system (up to a maximum of four modules).

Key Point: All the UPS modules connected to a parallel system must be of the same model type and power rating.

Module redundancy

If a system is designed with module redundancy it contains at least one UPS module over and above that necessary to power the system's connected load.

For example, if the system shown in Figure 2.3 comprises 3x10 kVA modules it could be employed as a redundant module system for a load of up to 20 kVA. This means that under normal circumstances each module shares the load equally and supplies up to 6.6 kVA; but if one module fails, or is taken off-line, the remaining two modules can sustain the full rated load by each serving 10 kVA. The ability to lose one module yet still provided the rated load with processed, backed-up power significantly increases the overall system reliability.

***Note:** If a parallel system is operating with a redundant module the `N+1` led will be fully illuminated on the all the module control panels.*

System-wide load transfer operation

All the UPS modules that are connected to the load in a parallel system must be in the same internal mode of operation at all times – i.e. it is not permissible for one module to be operating in an `ON-LINE` mode with the remaining modules in an `ON-BYPASS` mode, as such a situation would certainly damage the UPS modules.

***Note:** If any module in the system generates a `LOAD ON BYPASS` or `LOAD ON INVERTER` command it is signalled to all the connected modules via the parallel control bus so they will all simultaneously switch to the `ON-BYPASS` mode or the `ON-LINE` mode (provided a sufficient number of modules are available) accordingly.*

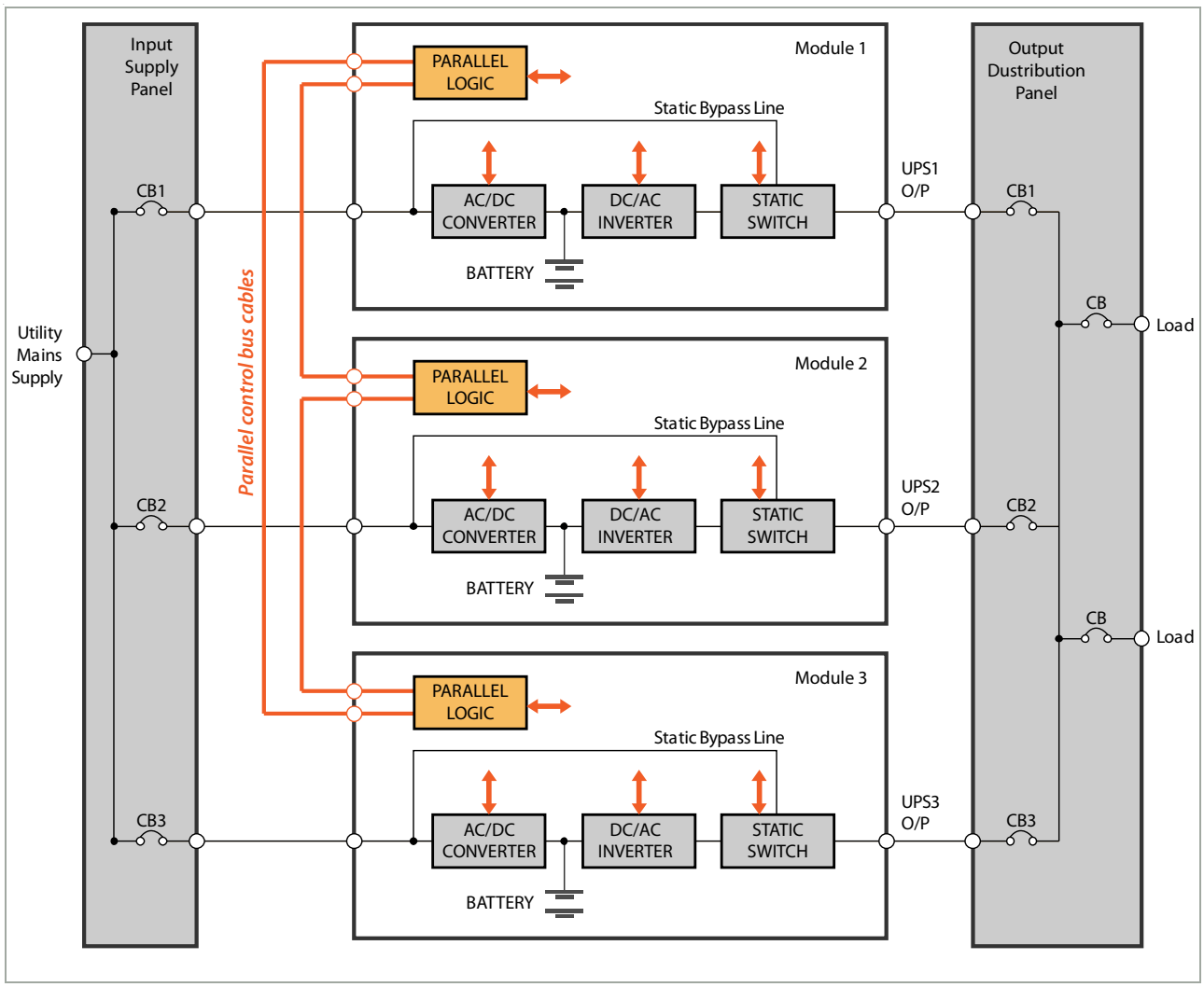


Figure 2.3 PowerWave 1000 UPS Parallel system

Inter-module frequency synchronisation and load sharing

Using sensing signals passed over the parallel control bus, each UPS is able to compare its own frequency and output current with that of its neighbouring modules and carry out fine adjustments to achieve balanced conditions.

Isolating a module from the system

As explained immediately above, if a parallel system is operating with module redundancy it is possible to isolate a module from the system for service or repair without affecting the remaining modules, or load. But in order to do this safely, each module should by connected to the utility mains through a dedicated input supply circuit breaker and each UPS output should be similarly connected to the load via a dedicated output circuit breaker – as illustrated in Figure 2.3.

Once a module's output circuit breaker is open there is no load power being drawn from its inverter and it can be shut down in the normal way without affecting the remain on-line modules.

2.4 Operator control panel

The UPS is fully controlled from the operator control panel located on the front of the unit.

The user-friendly UPS control panel comprises three areas:

Led indicators
A row of leds indicate the UPS input and output power status, together with a general fault warning.

Alpha-numeric LCD Display
Provides indication of the UPS operating mode together with the input, output, and battery supply parameters. It also displays error messages and UPS set-up data via a system of configuration menus.

Operator Keypad
The keypad contains 6 keys that are used to navigate through the UPS control menu system and turn the UPS OFF/ON.

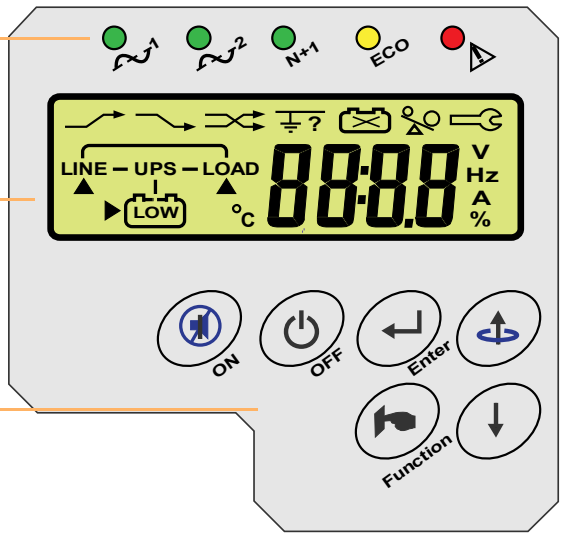


Figure 2.4 Operator control panel

2.4.1 LED Indicators

Input mains supply status
This led indicates that the utility mains voltage applied to the UPS input terminals is within the specified operating range (168~288 VAC) and is therefore normally illuminated. The led flashes if the supply falls to within 120~168 VAC and extinguishes altogether in the event of a total utility supply failure.

Bypass mains supply status
This indicates the state of the bypass mains supply. This supply is internally linked to the UPS input supply terminals in the 4.5 kVA, 6 kVA and 8 kVA models and this indicator will therefore reflect the utility supply status indication above; however in the 10 kVA the UPS bypass terminals are optional connected to a dedicated bypass supply.

N+1 Redundancy status
Used in a parallel system only. This led is fully illuminated when the number of on-line UPS modules exceeds the number required to power the existing load by at least one module – i.e. the system can afford to lose one module without having to transfer the load to the bypass supply due to an overload.
The led brightness will dim if the load increases (or the number of on-line modules decreases) to the point where system redundancy no longer exists.

ECO Mode
This led illuminates when the UPS is set to operate in the ECO mode, which is available on a single module installation only.

UPS fault indication
This LED illuminates to indicate a fault condition within the UPS that needs attention.

2.4.2 Operator keypad

ON Button
This button is used to turn ON the UPS, silence the audible alarm, and activate certain other functions when used in conjunction with other buttons (as described later in this chapter). To turn ON the UPS, the button must be held down for approximately five seconds, until two audible beeps are heard.

OFF Button
To turn OFF the UPS, this button must be held down for approximately five seconds, until two audible beeps are heard.

ENTER Button
The ENTER button is used to select a parameter from the UPS configuration setup menus.

UP (BACK) Button
This button is used to navigate UP through the UPS menus.

DOWN (NEXT) Button
During normal operation, this button is used to scroll through the metered parameters shown on the LCD display. It is also used two navigate forward through the UPS configuration setup menus.

FUNCTION Button
This button is used to access the UPS configurations setup menus.

2.4.3 LCD Display

The LCD has three functional areas that can be broadly described as Warning Symbols, Mimic Diagram and a four digit Alpha-numeric Display. Each of these areas are described individually below.

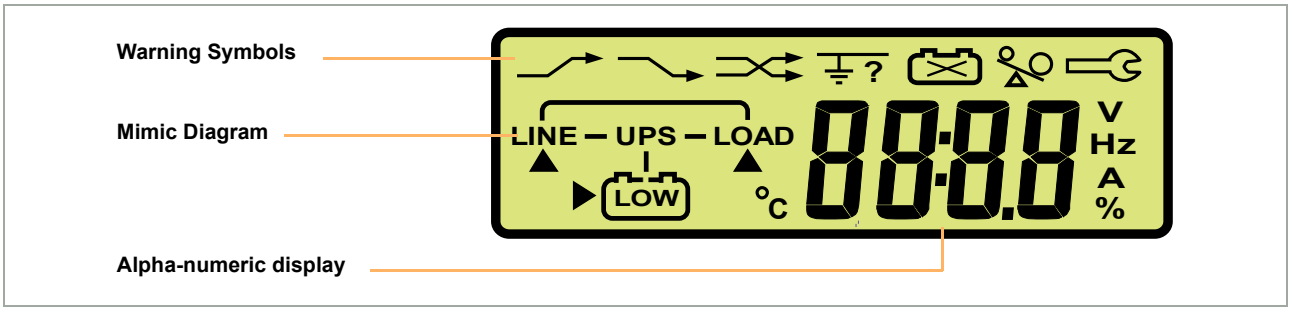


Figure 2.5 LCD Display

Four digit alpha-numeric display

The four digit alpha-numeric display provides a metering facility which can be selected to show the input voltage/ frequency, output voltage/frequency/load together with battery voltage and the internal enclosure temperature. Details of the meter facilities are shown on page 40.

A variety of operating status and fault codes are also shown on the display, as described throughout this manual.

Warning symbols

Low battery:
This warning symbol appears if the battery voltage is low.

Battery fault:
This symbol indicates that there is a battery fault.

Overload:
This symbol indicates a UPS overload.

Supply fault:
This symbol indicates an input supply problem, such as reversed Line-Neutral.

Service mode:
This symbol indicated that the UPS is operating in Service mode.

Load transfer
Load transferred to bypass due to loss of UPS (inverter) output.

Bypass defective
Load unable to transfer to bypass, in ECO mode, due to defective bypass,.

Utility supply defective
Utility supply defective at the UPS input terminals.

Mimic diagram

LCD Mimic diagram
The LCD Mimic indicates the existing power flow through the UPS. The LINE, UPS, LOAD and BATTERY symbols are permanently shown on screen and their interconnecting lines appear depending on the UPS mode of operation – see below.

Note: the arrowheads shown in Figure 2.6 are used in conjunction with the LCD meter display to identify the source of the meter indication.

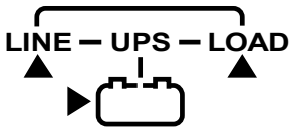
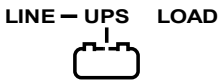
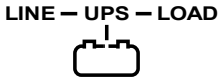


Figure 2.6 LCD Mimic diagram

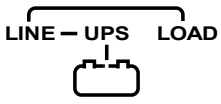


UPS OFF
This mimic is displayed when the utility power is first applied to the UPS, or if the UPS is turned OFF due to a fault. It shows that the battery is being charged from the utility (LINE) but the LOAD is isolated from the UPS, and is therefore unpowered.



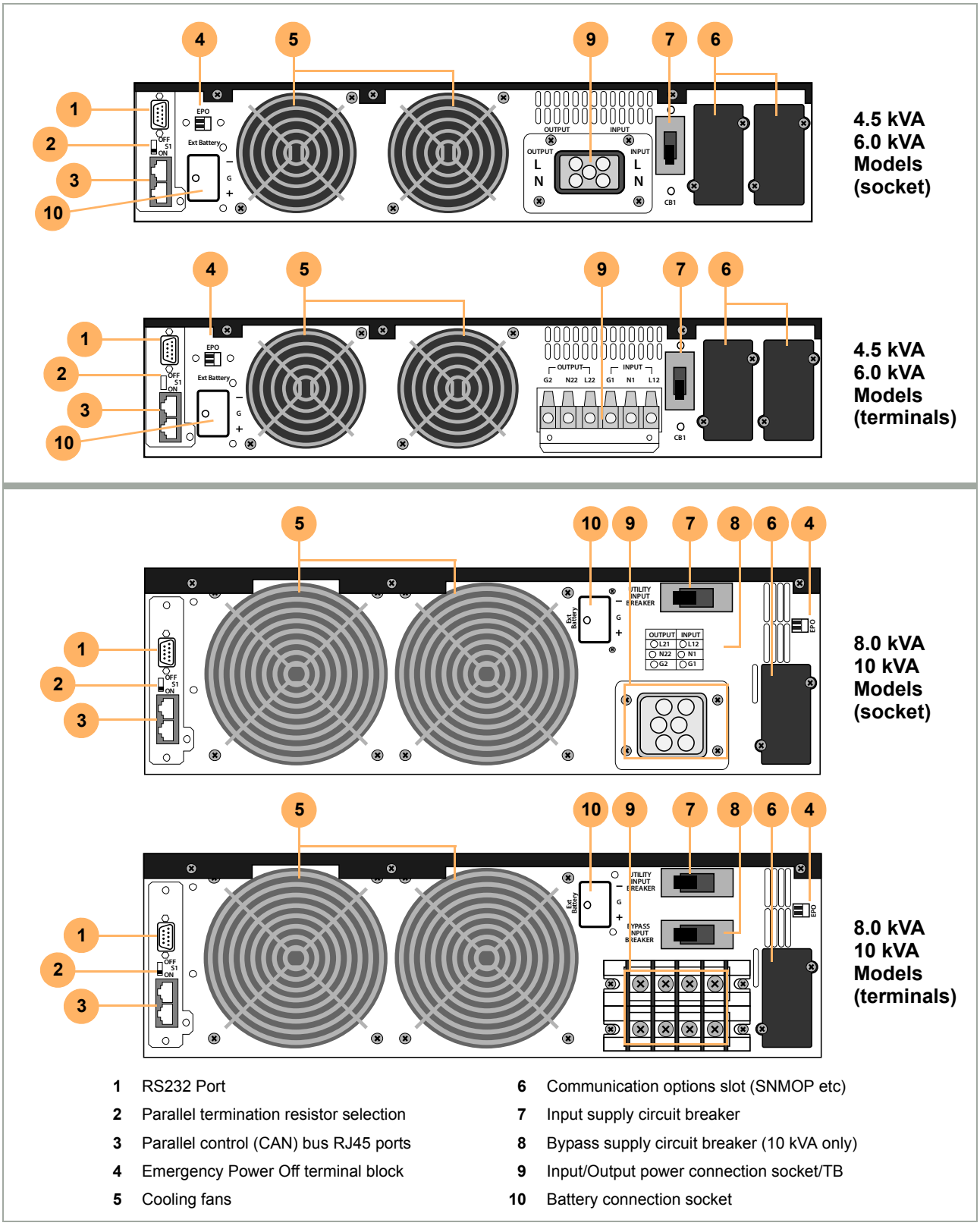
UPS ON
This mimic is displayed during normal UPS operation. It shows the battery being charged from the utility (LINE) and the LOAD connected to the UPS output – and therefore being supplied with processed, backed-up power.

ON BATTERY MODE
This mimic is displayed if the utility supply fails. It shows the battery now providing the UPS and LOAD power. The battery will sustain the UPS output until it is discharged, whereupon the UPS will shutdown.



LOAD ON BYPASS MODE
This mimic is displayed if the UPS develops a fault (or is overloaded), whereupon the load is transferred to the bypass line and therefore connected directly to the unprotected utility supply (LINE). The battery will remain on charge if the UPS charger is healthy.
The load can be manually switched from the UPS to Bypass by pressing the OFF button for approximately 5 seconds, or from the Bypass to UPS by pressing the ON button.

2.5 UPS Enclosure rear panel



1	RS232 Port	**6**	Communication options slot (SNMOP etc)
2	Parallel termination resistor selection	**7**	Input supply circuit breaker
3	Parallel control (CAN) bus RJ45 ports	**8**	Bypass supply circuit breaker (10 kVA only)
4	Emergency Power Off terminal block	**9**	Input/Output power connection socket/TB
5	Cooling fans	**10**	Battery connection socket

Figure 2.7 UPS Enclosure rear panel detail

2.5.1 Communication options

Several communication options can connected to the PowerWave 1000 rear panel. These are described briefly below with further details provided in chapter 8 (Options).

RS-232 Interface port (Figure 2.7 item 2)

The RS-232 port also allows the UPS to be connected to a PC. It can be used with the UPS external monitoring and shutdown software (WAVEMON) and with the supplied UPS Configuration Software.

The RS-232 interface should be set as follows:

Baud Rate	2400 bps
Data Length	8 bits
Stop bit	1 bit
Parity	None

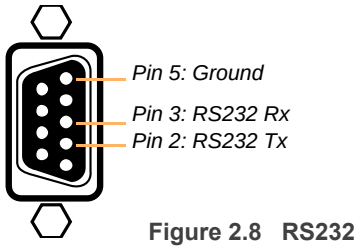


Figure 2.8 RS232

Emergency power off (EPO) (Figure 2.7 item 4)

If an external emergency power off (EPO) facility is required, a normally-open circuit must be connected to the two pin plug located on the UPS enclosure rear panel. When the external emergency power off circuit is operated it connects a short-circuit across these terminals and effects a total UPS shutdown. A plug-in connector with screwed terminals is supplied ready fitted to the EPO socket to simplify the connection of the external cable if the UPS is located in a confined space such as when it is rack mounted.

Optional interface card slot (Figure 2.7 item 6)

Four optional interface cards are available to meet various communication needs: DCE (dry contact relay card), R2E, USE and SNMP/Web. These cards can be fitted into the options slot located behind a blanking plate on the UPS back panel, as shown. Full installation and set-up procedures are provided in chapter 8.

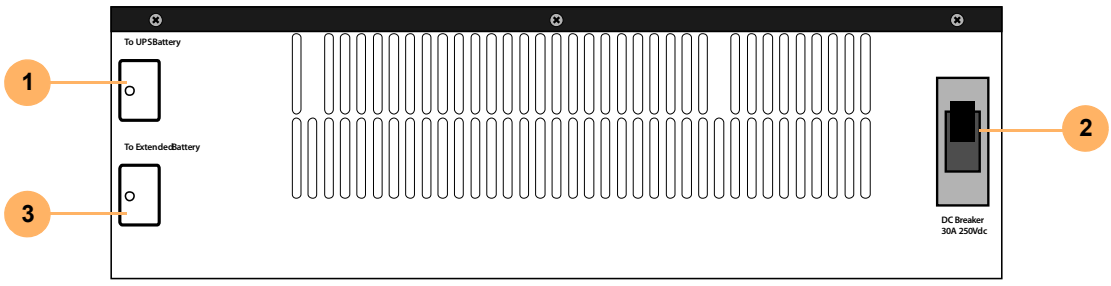
The software bundled with the UPS is compatible with most operating systems including Windows 98, 2000, ME, NT and XT. For other applications, such as Novell Netware, Unix or Linux please contact your local dealer for suitable products.

All of the fitted communication ports, including the optional cards, can be active and used simultaneously to monitor the UPS status. However, only one communication (the one with the highest priority) has the ability to command and control the UPS at any given time.

The priority of the communication interfaces are:

1. EPO input port.
2. Optional slot-mounted interface card.
3. RS-232.

2.6 Battery enclosure rear panel



1 Battery cable connection from UPS enclosure.

2 Battery circuit breaker.

3 Battery cable connection to Extended Battery enclosure (option).

Figure 2.9 Battery enclosure rear panel detail

2.7 Warranty

The PowerWave 1000 UPS is supplied with a limited warranty that the UPS and its component parts are free from defects in materials and workmanship for a period of one year from the date of commissioning, or fifteen months from the date of original delivery, whichever is the sooner.

This warranty is the only warranty given and no other warranty, express or implied, is provided.

This warranty is invalidated if the UPS is used without having been commissioned by a fully trained and authorised engineer.

The warranty does not apply to any losses or damages caused by misuse, abuse, negligence, neglect, unauthorised repair or modification, incorrect installation, inappropriate operating environment, accident, act of God, or inappropriate application.

If the UPS fails to conform to the above within the warranty period then Uninterruptible Power Supplies Ltd will, at its sole option, repair or replace the UPS. All replaced parts will remain the property of Uninterruptible Power Supplies Ltd.

As a general policy, Uninterruptible Power Supplies Ltd does not recommend the use of its products in:

- life support applications where failure or malfunction of the product can be reasonably expected to cause failure of the life support device, or to significantly affect it's safety or effectiveness.
- applications concerned with direct patient care.

Uninterruptible Power Supplies Ltd will not knowingly sell its products for use in such applications unless it receives in writing assurances satisfactory to Uninterruptible Power Supplies Ltd that:

- the risks of injury or damage have been minimized.
- the customer assumes all such risks.
- the liability of Uninterruptible Power Supplies Ltd is adequately protected under the circumstances.

CAUTION: *The UPS contains batteries that must be re-charged for a minimum of 12 hours every three months to prevent deep-discharging. Batteries that have been deep-discharged, for whatever reason, are not covered by this warranty.*

2.7.1 Extended warranty

The standard warranty may be enhanced by protecting the UPS with an extended warranty agreement (maintenance contract). An extended warranty agreement enhances the standard warranty by providing the following:

- regular preventative maintenance inspections.
- guaranteed speed of response to operational problems.
- 24 hour telephone support.
- fully comprehensive cover (excluding batteries and capacitors).

Contact the Service Support Hotline on 0800 731 3269 for further details.

2.7.2 Additional service/maintenance support

In addition to providing support for the PowerWave 1000 UPS, Uninterruptible Power Supplies Ltd can provide maintenance and support on a wide range of different UPS products.

If you are interested in an extended warranty for your PowerWave 1000 UPS, or for any other UPS products you may have, please complete the enquiry form shown below and return or FAX it to:

Uninterruptible Power Supplies Ltd.	
Woodgate	
Bartley Wood Business Park	Tel: 01256 386700
Hook	0800 731 3269 (24 Hr.)
Hampshire	Fax: 01256 386701
RG27 9XA	Email: service@upspower.co.uk

2.8 Extended Service enquiry form

Fax to: 01256 386701 ***www.upspower.co.uk***

Uninterruptible Power Supplies Ltd.
Woodgate
Bartley Wood Business Park
Hook
Hampshire
RG27 9XA

Tel: 01256 386700

Name: .....
Job Title: .....
Company: .....
Address: .....
.....
.....
.....
Post Code .....
Tel. .....
Fax. .....
E-mail .....

Please contact me to discuss:

☐ Extended Warranty options for my PowerWave 1000 UPS

☐ Extended warranty options for my UPS System as below:

Manufacturer:.....
Model Nº:.....
Rating kVA:.....

☐ Replacement Batteries.....

☐ Other .....(please specify)

Thank you for your enquiry, which will receive our prompt attention.
If you need to contact us immediately call free on,
Freefone 0800 731 3269
or E-mail us on service@upspower.co.uk
www.upspower.co.uk

3 Installation and Set-up

CAUTION: *Read the safety information contained in chapter 1 before installing the UPS.*

3.1 Unpacking the UPS equipment

The manufacturer has designed robust packaging for your product to help ensure it reaches you in good order; however, accidents and damage may sometimes occur during shipment. You should inspect the UPS carefully upon receipt and if there are signs of damage you must inform the carrier and dealer immediately.

WARNING: Under no circumstances should you connect electrical power to a damaged unit or attempt to start it using its batteries.

The packaging is recyclable; save it for re-use or dispose of it appropriately and correctly.

1. Remove the UPS from the packing carton.
2. Check the package contents. The standard unit includes:
   a) User Manual.
   b) A set of UPS communication software complete with RS232 cable.
   c) A mounting accessories kit which allows the UPS/Battery cabinets to be configured for Tower or Rack installation.
   d) Battery connecting cable.
3. Before proceeding with the installation, check that the voltage and power ratings on the data plate located on the rear of the UPS matches the equipment order details. Contact your dealer if this is incorrect.

3.2 Selecting a suitable installation location

As the UPS weighs several kilograms, the intended location must e able to safely support its weight.

To ensure correct operation and a long service life, the site where the UPS is to be installed must satisfy the following environmental condition:

- The UPS must be installed in a sheltered location. It is not designed for outdoor use.
- The installed location must be dry and free of excessive dust.
- The UPS must not be installed in a corrosive environment or in the vicinity of flammable items.
- The ambient temperature and humidity must be within the limits specified in chapter 9 of this manual.
- The ventilation grills at the front of the UPS and extractor fans at the rear of the UPS must not be obstructed.
- The UPS equipment must be installed with the clearances illustrated in Figure 3.1 as a minimum.

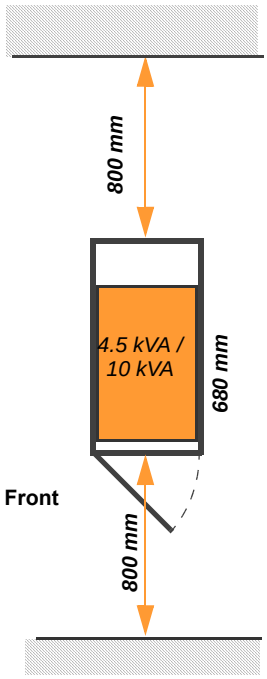
3.2.1 Clearances

Rack mounting

When rack mounting the UPS in a standard 19 in cabinet, a minimum cabinet depth of 900 mm is required in order to provide an adequate exhaust airflow from the cooling fans on the rear of the UPS enclosure.

An adjustable rack mounting kit that can be extended to fit a 900 mm cabinet is available.

A clearance of 800 mm (31 in) is required at the rear of the rack to permit pedestrian access to cable-up the UPS; and 800 mm is also required at the front of the rack to allow sufficient room to lift and install the enclosures onto the rack mounting rails or shelf.
Due to weight distribution considerations, the UPS and Battery enclosures must be kept level while they are inserted into the rack to prevent them from tilting backwards.

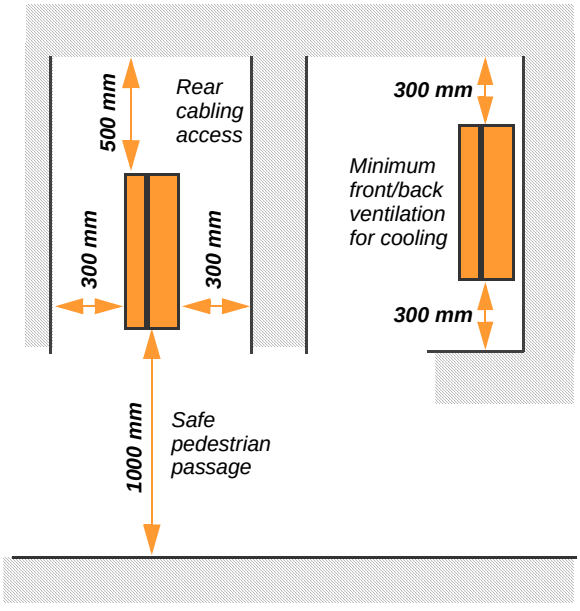


Tower mounting

With regards to a Tower installation, there are two sets of clearance criteria to consider; the first is to satisfy the ventilation requirements, and the other concerns the installation cabling access.

For ventilation purposes, a minimum of 300 mm (12 in) free space must be provided at the front and rear of the UPS to permit adequate cooling air flow; however, a rear clearance of 500 mm (20 in) and side clearance of 300 mm (12 in) is necessary to gain cabling access to the rear of the UPS.

Depending on the installed location, a compromise can sometimes be achieved by installing the enclosure with a sufficient cable length to enable it to be pulled forward sufficiently for rear access.
If the UPS is installed in a location which is subject to regular pedestrian passage, it is recommended that the front clearance is increased to at least 1000 mm (40 in).



UPS Enclosure tower footprint

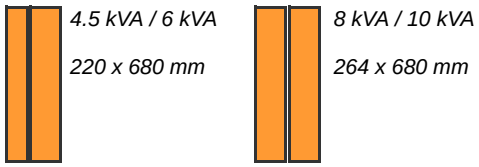


Figure 3.1 UPS Location clearances

3.3 Tower hardware configuration set-up

Using the components shown in Figure 3.2, which are supplied as standard for both the UPS and battery enclosures, the UPS can be configured as a floor-standing Tower unit, as follows:

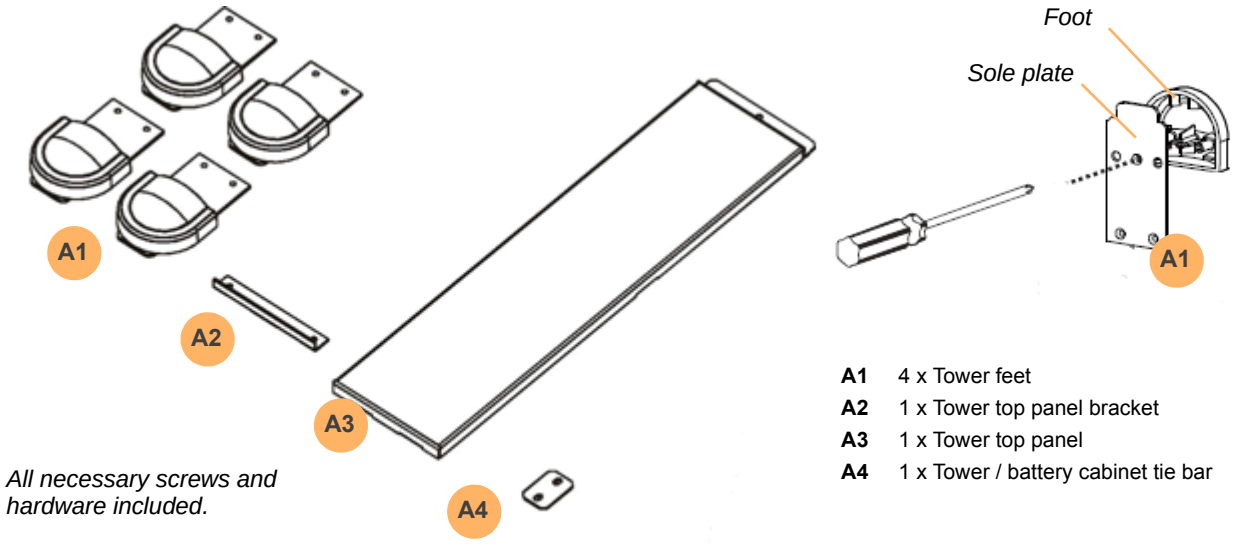


Figure 3.2 Tower configuration kit

1. First, assemble two tower feet (A1) by attaching the foot to the sole plate (see Figure 3.2).
2. Turn the UPS enclosure on its side and attach the two assembled tower feet to the enclosure's left hand base, as shown in Figure 3.3 top diagram.
3. Attach two tower feet sole plates (without feet) to the enclosure's right hand base so that they do not protrude from the side of the enclosure as shown in Figure 3.3 top diagram.
   This is necessary to ensure the UPS enclosure stands level when it is turned back onto its feet.
4. Repeat steps 1 to 3 on the base of the battery enclosure; but in this case ensure that the protruding feet are fitted to the battery enclosure's right hand side.
   Note that Figure 3.3 lower diagram is provided to illustrate the positional relationship between the UPS and battery enclosure feet only. In practice, the UPS enclosure would not normally be laying on top of the battery enclosure while fitting the battery enclosure feet.
5. Carefully lift both assemblies and stand them on their feet adjacent to each other with the battery enclosure to the right of the UPS enclosure (see Figure 3.4).

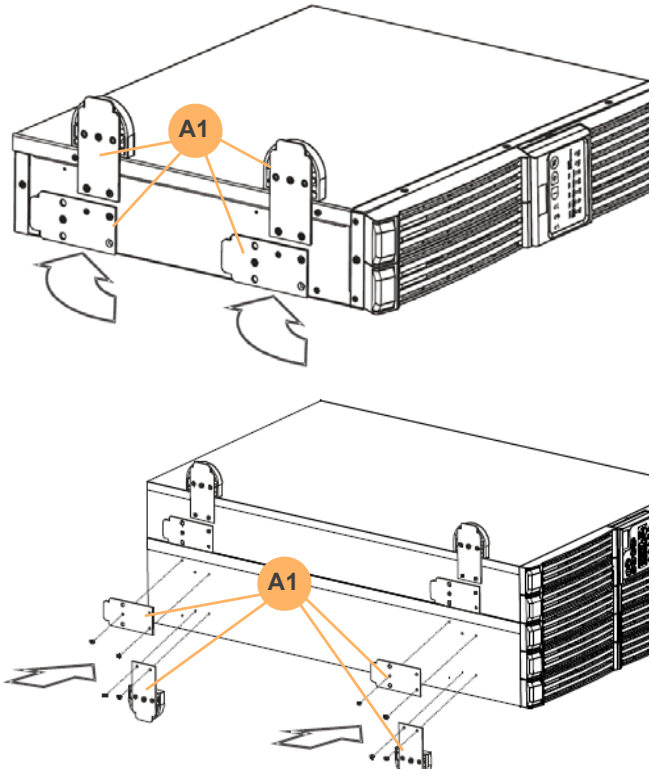


Figure 3.3 Attaching the enclosures' feet

6. If necessary, rotate the UPS control panel so that it is correctly orientated. To achieve this, carefully pull the control panel forward to unclip it from its mounting, rotate it to the correct angle, then relocate it and press it back into place.
7. Remove three screws from the top of the each enclosure (two from the front and one from the back), as identified in the top diagram of Figure 3.4.
8. Remove two screws from the top of each enclosure as identified in the bottom diagram of Figure 3.4.
9. Fit two tie bars (A3) between the enclosures, using screws S1, to secure them together (Figure 3.4 bottom diagram).
10. Attach the angle brackets (A2) to the top front of the UPS enclosure, using two screws, such that the lip of the bracket faces the front of the enclosure. (Figure 3.4 top diagram).
11. Locate the new UPS enclosure top panel (A3) into the bracket (A2) and secure it in place by screwing it to the top rear of the enclosure using a single screw.
12. Repeat the above two steps to fit the new top cover to the battery enclosure.
13. Move the completed UPS tower assembly to its final location then connect the battery cable between the UPS and battery enclosures. The battery cable must be secured in place using the clamp (attached).
14. This completes the tower hardware configuration. The UPS should now be commissioned as detailed in paragraph 3.6 before it is put into service.

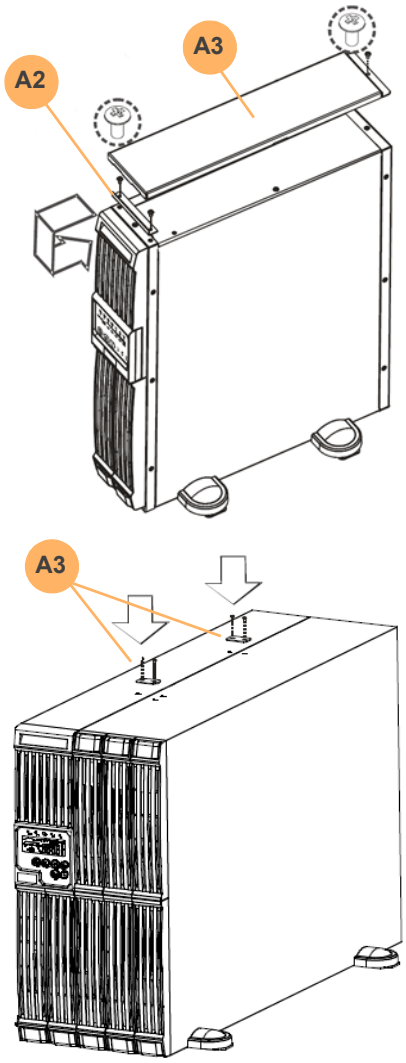
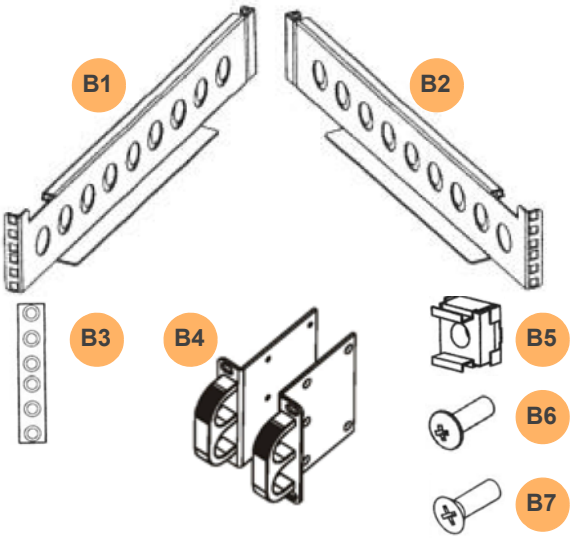


Figure 3.4 Tower configuration

3.4 Rack configuration set-up

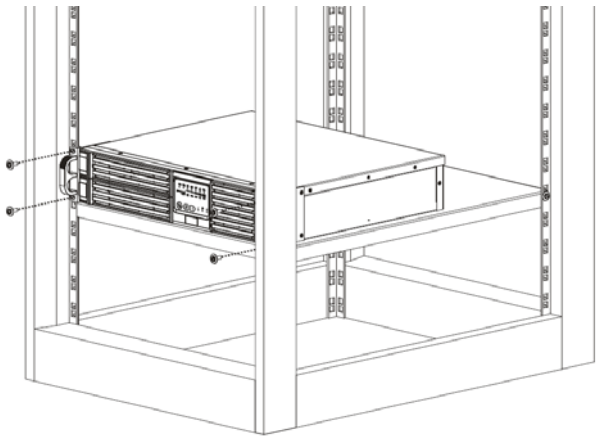


B1 1 x Adjustable mounting rail (Left)
B2 1 x Adjustable mounting rail (Right)
B3 2 x Adapter plate
B4 2 x Rack mounting handle
B5 12 x Captive nuts
B6 8 x Dome head bolts
B7 4 x Countersunk bolts

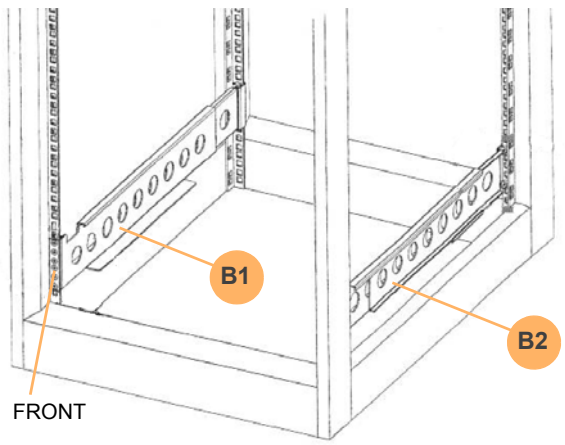
Figure 3.5 UPS Rack mounting kit

The PowerWave 1000 UPS and battery enclosure(s) can be installed in a standard 19 inch rack, and can be either shelf mounted or installed on adjustable mounting rails that are provided as part of the rack installation kit. If the batteries are housed in a separate enclosure, it should be mounted on an adjacent shelf in the same rack using same procedure as mounting the UPS. The two enclosures are then later connected together using the supplied interconnecting cable.

CAUTION: *When rack-mounting the equipment always install it at the bottom of the cabinet with the battery enclosure installed below the UPS enclosure.*



Shelf mounting



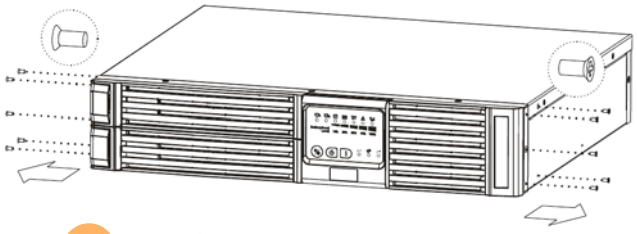
Adjustable mounting rails

Figure 3.6 Rack mounting options

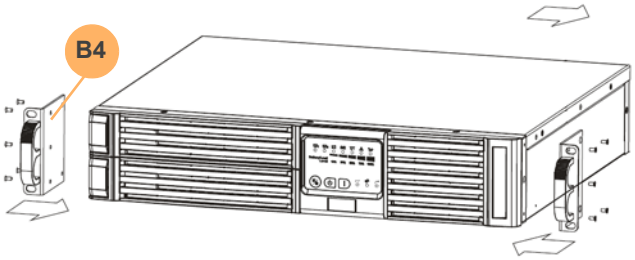
3.4.1 Installing the adjustable mounting rails

The adjustable mounting rail kit contains a pair of mounting rails (left and right handed) that are fitted to each side of the cabinet and secured by two screws – front and back. The rails can be extended to any length between 543 mm and 925 mm and are compatible with most standard 19 inch rack assemblies of 600 mm to 900 mm depth.

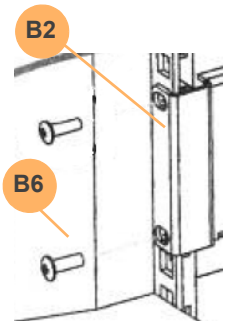
1. Remove five screws from the front of both sides of the UPS.



2. Attach a mounting handle assembly (B4) to both sides of the UPS enclosure, using the holes vacated in the previous step to secure the handles in place.



3. Extend the adjustable mounting rail and hold in place (see Figure 3.6).
4. Align the two holes in the back of the adjustable mounting rail with the holes in the cabinet's vertical fixing rail.
5. Identify and mark the two vertical fixing rail holes to which the adjustable mounting rail is to be fixed.
6. Clip captive nuts (B5) to the two vertical fixing rails holes identified above.
7. Secure the rear of the adjustable mounting rail to the vertical fixing rail using two dome headed bolts (B6).



8. With the rear of the adjustable mounting rail secured in place, and the adjustable mounting rail extended, identify the four fixing points that will align with the equipment mounting handles and clip four captive nuts to the required fixing points.

   Note: *The fixing points will vary according to the equipment height (2U, 3U, 4U) as shown in Figure 3.8.*

9. Secure the adjustable mounting rail to the rack's front vertical fixing rail using two countersunk bolts (B7) and adapter plate (B3) *(see Figure 3.8).*
10. Repeat the steps 1 to 9 above to fit the second adjustable mounting rail.

WARNING: The UPS / Battery enclosure is heavy. When lifting the equipment ensure that adequate manpower is available and any mechanical lifting aids are suitable for the weights involved.

WARNING: When inserting the enclosure into the rack ensure that it is held level. If it is inserted at an angle it could pivot about the back of the mounting rail runners if the front of the enclosure is tilted upwards.

11. When both mounting rails are fitted, carefully insert the UPS / Battery enclosure into the rack so that it rests correctly on the rails. Then secure it in place using the four dome head bolts (B6) as shown in *Figure 3.8.*
12. The UPS should now be commissioned as detailed in paragraph 3.6 before it is put into service.

Figure 3.7 Adjustable mounting rail installation

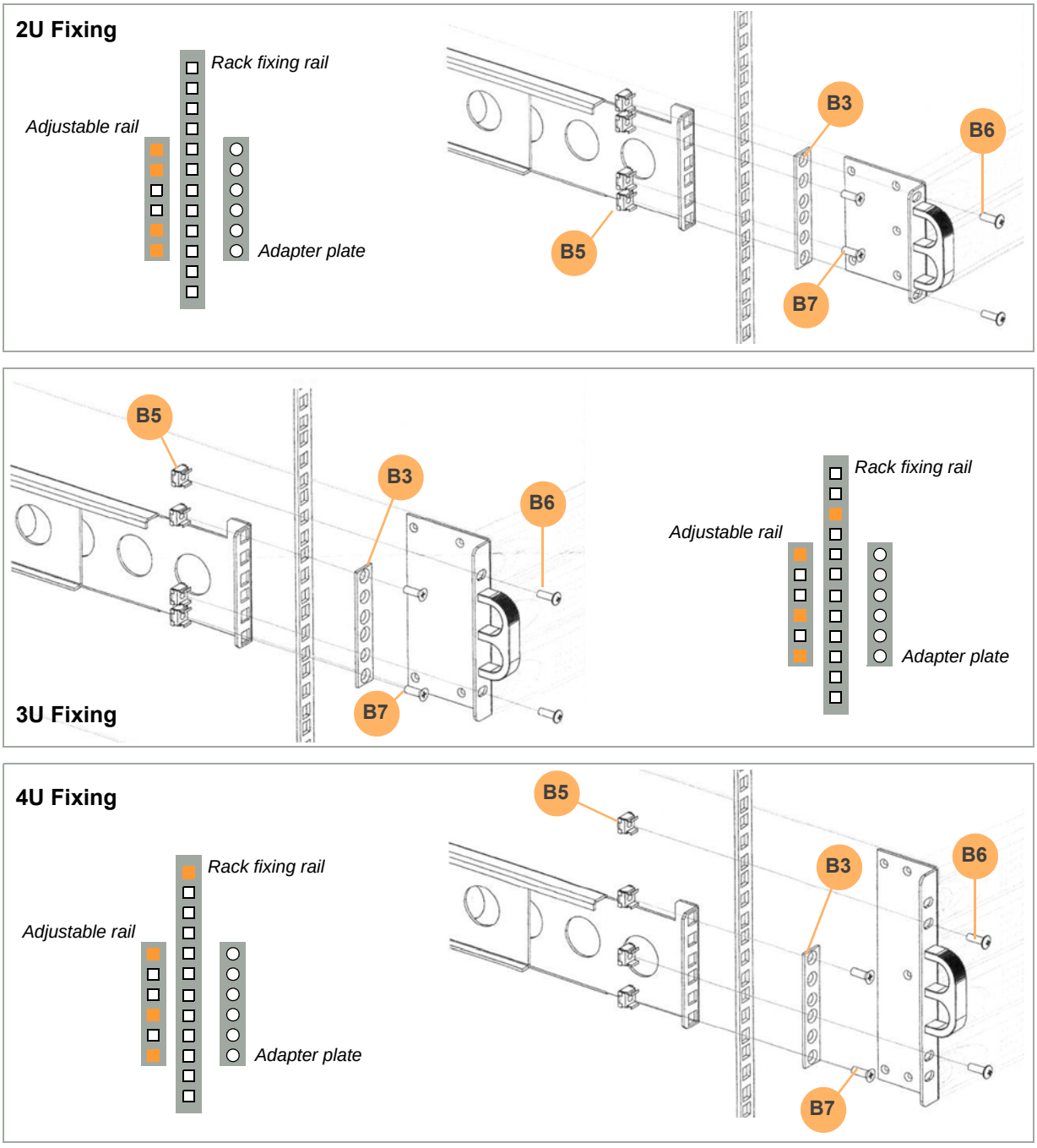


Figure 3.8 Fixing points for captive nuts

Once the UPS has been installed, if necessary, rotate the UPS control panel so that it is correctly orientated. To achieve this, carefully pull the control panel forward to unclip it from its mounting, rotate it to the correct angle, then relocate it and press it back into place.

3.5 Electrical Wiring

In addition to the UPS input and output power cables, the UPS requires the following cables to be connected prior to commissioning (depending on the installed options and UPS system configuration):

- Battery connection cable – required for all modules.
- Parallel control bus cables – required for parallel system only.
- Emergency power off (EPO) – optional for all systems (see page 15).
- Communications options – optional for all systems (see Chapter 8).

General cabling notes

In order to minimise any problems due to noise interference always use separate cable runs for the various power cables and control cables. In particular, if the control cables have to run parallel to the power cables keep a separation distance of 20 cm if possible. Do not attach the control cables to the power cable looms using cable ties, spiral-wrap or any other means. Where the control cables have to cross the power cables make best effort to ensure they do so at an angle of 90º.

3.5.1 Power cables

Depending on the model variant, the UPS input and output power cables can be connected either by means of a plug/socket connector or hard-wired to a terminal block. If a plug/socket arrangement is used then a ready cabled plug will be supplied with the UPS equipment. If a terminal block connection is used then the provision of all external cables and fuses (or circuit breakers) used to connect the UPS input and output terminals to their respective distribution panels is the responsibility of the customer. All cables and fuses should be rated according to the maximum UPS system rating in accordance with local regulations.

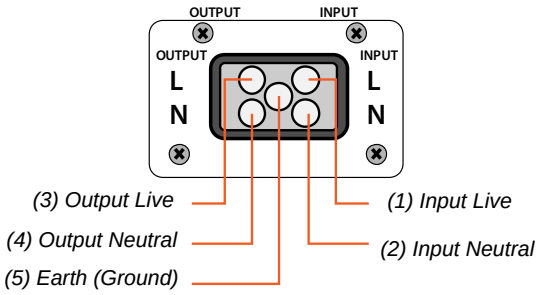
For guidance:

- Fuse and cable recommendations must be to IEC 60950-1:2001.
- All external fuses, isolators and power cables must be rated and installed in accordance with the prescribed IEC standards or local regulation – e.g. BS7671:2008.

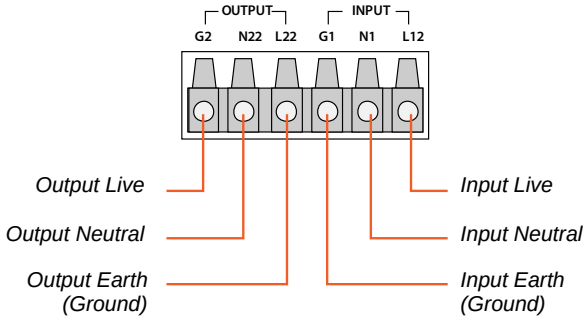
Parallel system power cable considerations

In order to obtain the optimum balanced conditions, when cabling a parallel module system you should ensure that the input cables to each module are of equal length and not longer than 25m. The output cables from all modules to the load distribution panel should similarly be of equal lengths and a maximum of 25m.

4.5 kVA and 6.0 kVA UPS



A plug complete with pre-wired power cables is supplied with the UPS.
To connect the power:
Remove the cover from the socket on the back of the UPS.
Fit the cabled plug into the socket and lock it in place using the clamp bar located on the socket housing.

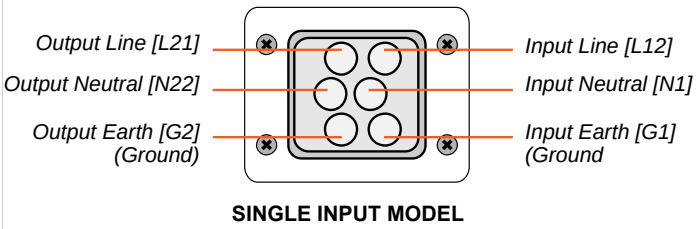


All cables must be supplied by the customer.
To connect the power:
Open the terminal block on the back of the UPS.
Connect the individual input/output power cables and secure them in place using the two clamps fitted to the inside of the terminal block cover.

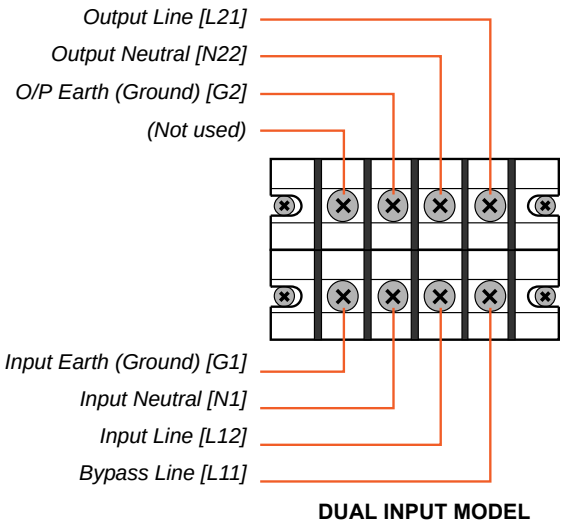
SYSTEM RATING	UPS			BATTERY	
	Max. Current	Conductor	Torque	Max. Current	Conductor
4.5 kVA	25A	6 mm²	2 Nm	19A	6 mm²
6.0 kVA	33A	10 mm²	2 Nm	25A	6 mm²

Figure 3.9 4.5 kVA & 6.0 kVA power connections

8.0 kVA and 10.0 kVA (single phase input) UPS



SINGLE INPUT MODEL



DUAL INPUT MODEL

The cabling methods for the 8.0 kVA and 10.0 kVA are similar to those described above for the smaller models.
The major difference is that the terminal block version can have an optional split bypass facility whereby the utility input and bypass input supplies can be connected to independent sources.

SYSTEM RATING	UPS			BATTERY	
	Max. Current	Conductor	Torque	Max. Current	Conductor
8.0 kVA	43.4A	10 mm²	2 Nm	33A	6mm²
10.0 kVA	54.3A	16 mm²	2 Nm	41A	10 mm²

Figure 3.10 8.0 kVA and 10 kVA (single phase) power connections

10.0 kVA (three phase input) UPS

The 10.0 kVA UPS model is available as a three-phase input (single phase output) version, and connected as shown.

10 kVA 3 Phase input UPS	
Input lines max current	54.3 A
Input lines conductor	16 mm² or 25 mm²
Input Neutral	16 mm² or 25 mm²
Output max current	54.3A
Output conductor	16 mm² or 25 mm²
Battery max current	41A
Battery conductor	10 mm²

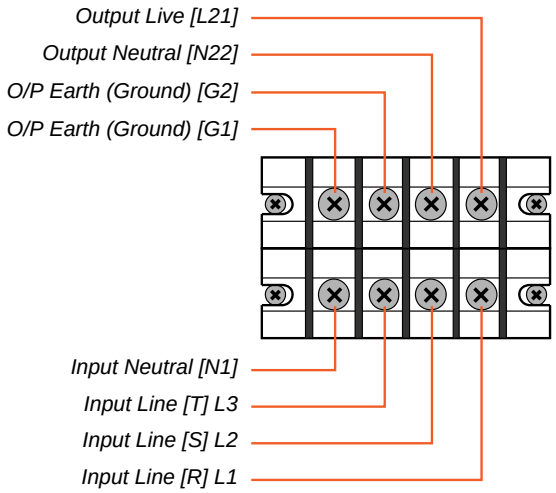


Figure 3.11 10 Kva (three phase input version) power connections

3.5.2 Parallel control cables

In a parallel module system a control bus, formed by RJ45 terminated cables, is connected between all the UPS enclosures in a 'ring' configuration.

The cables are held in-situ by a metal clamp which is secured by two screws, as illustrated.

Note that, although in practice the UPS modules are usually positioned close to each other, the maximum parallel bus cable length is 7m.

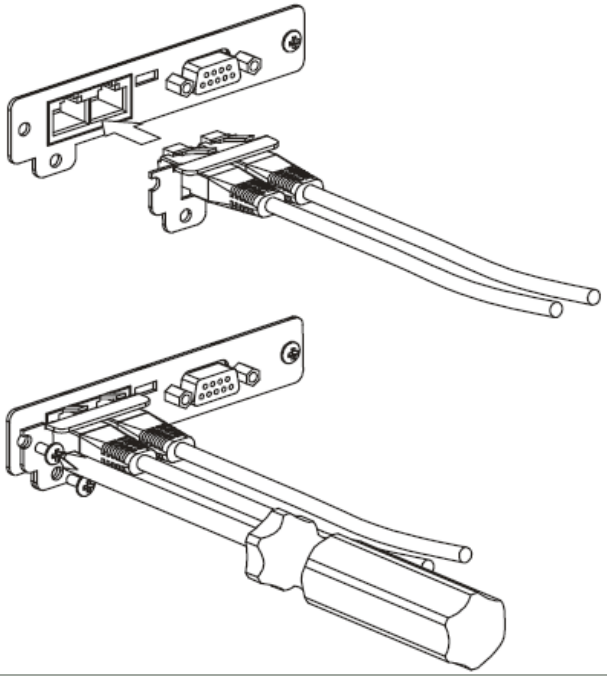


Figure 3.12 Parallel control bus cable connection

Key Point: For a parallel system it is necessary to utilise a bespoke distribution panel for the UPS input and output connections. Contact UPS Limited for details.

3.6 Commissioning procedure (single module system)

Use this procedure to commission a single (stand-alone) UPS system.

Before the UPS is put into service, it should be configured to suit the local electrical supply and load application. This can be considered a 'once-only' commissioning procedure and, once completed, will only need to be repeated if the application requirements change.

***CAUTION:** Before you carry out this procedure you must be familiar with the Operator Control Panel functions and the rear panel connections (see paragraph 2.4 and paragraph 2.5).*
You should also be familiar with the safety information contained in Chapter 1.

1. Check that the utility supply voltage matches the input voltage range specified on the UPS data plate.
2. Connect the UPS output cables but ensure the load is isolated from the UPS output – load distribution isolator(s) open.
3. Connect the battery cable (supplied) between the UPS enclosure and battery enclosure (see Figure 2.7). Note that the connector should be secured in place using the supplied metal bracket.
4. Connect the UPS input power cables to the utility supply (and bypass supply cables to the bypass mains supply if using a split bypass input option on the 8 kVA and 10 kVA models) as described in paragraph 3.5.1.
5. Turn ON the utility/bypass supply, close the input circuit breaker and the battery circuit breaker, located on the rear of the enclosures.
   a) The LCD Display will turn on and all of its symbols will illuminate for approximately 3 seconds.
   b) The status leds will all turn on for approximately 3 seconds and then extinguish except for the utility input supply and bypass supply (green) leds, which will remain lit.
   c) The LCD panel will indicate that the battery is on charge and the UPS is oFF.
6. Simultaneously press and hold the ON and DOWN buttons for 3~5 seconds, until a beep is heard, and then release them.
   a) The LCD will display b_on. This indicates that the UPS is now in its set-up mode.

Bypass voltage window

7. Press the DOWN button twice.
   a) The LCD indication will scroll through tnon and end up showing either S_Lo or S_HI. This indicates the applied bypass voltage window.
   S_Lo sets the bypass window to 184~260 VAC and S_HI sets it to 195~260 Vac.
8. Press the UP button to select the wanted bypass voltage window (either S_Lo or S_HI is displayed).

Inverter frequency sync window

9. Press the DOWN button.
   a) The LCD indication will now show either St01 Hz or St03 Hz. This indicates the permitted bypass frequency window to which the UPS inverter will synchronise.
   St01 Hz sets the frequency window to ±1 Hz and St03 Hz sets it to ±3 Hz.
10. Press the UP button to select the wanted bypass frequency sync window.

Inverter output voltage

11. Press the DOWN button.
    a) The LCD indication will now show either o200 V, o208 V, o220 V, o230 V or o240 V.
    b) Press the UP button to select the required output voltage.

Input/Output frequency changer mode

The UPS can be configured to operate as either a 50/60 Hz or 60/50 Hz frequency changer.

***Note:** When operating in a frequency changer mode the bypass supply is disabled.*

12. Press the DOWN button.

a) The LCD indication will now show either norL, Eco, c50 Hz or c60 Hz.
norL = normal operation with 50 Hz input and output (default),
Eco = Economy mode (On bypass for normal operation)
c50 Hz = 60/50 Hz frequency changer, and c60 Hz = 50/60 Hz frequency changer.

13. Press the UP button to select one of the frequency changer modes if required.

Inverter output fine adjustment

14. Press the DOWN button.
    a) By default, the LCD indication will now show oA 0 %.
    b) If you want to trim the output voltage, press the UP button to cycle through the available options and select the required value – oA 1 %, oA 2 %, oA 3 %, oA-1 %, oA-2 %, oA-3 %.

Parallel ID Number

15. Press the DOWN button.
    a) For a single module operation the parallel ID number must be set to 1 d01 (default).
    If this is set incorrectly the UPS LCD will display error message Er 17 when it is started.

Parallel Function

16. Press the DOWN button.
    a) For a single module operation the parallel function must be set to P 01 (default).
    If this is set incorrectly the UPS LCD will display error message Er2 1 when it is started.

Confirm & Save

17. Press the **DOWN** button.
    a) The LCD indication will now show SAvE.
    b) If you want to double-check all the selected values you can scroll through the above list of parameters by repeatedly pressing the DOWN button and make any necessary further changes.
    c) Once you are satisfied that all the selected values are correct, with SAvE shown on the LCD display press the ENTER button to store the selected values in the UPS memory.
    d) The LCD panel will revert to indicate the battery is on charge and UPS is oFF.

__Note:__ Once the configuration has been saved you must turn OFF the UPS and temporarily turn off the input utility supply before you can access the setup mode again using the ON and DOWN buttons. This is a safety measure designed to prevent the UPS operating parameters from being changed while it is on-line.

3.6.1 Initial UPS power-up

1. The optional UPS communications cards can be fitted at this point or installed later, as required (see Chapter 8 for option card details).
2. Turn ON the UPS as described in paragraph 4.1.1.
3. Check all metered parameters to ascertain that the indications are correct (see page 40).
4. Leave the battery on charge for 4 hours.

   __Note:__ You can charge the batteries with the UPS output turned OFF as long as its utility input supply is connected and turned ON.

5. Carry out a battery test, as described in paragraph 4.2.3.
6. If the battery test is successful, the UPS can now be put into service.

__CAUTION:__ It is recommended that the battery is charged for further 4 hours before connecting any critical load. This is to ensure that the battery is charged to a level that enables the UPS to perform to full specification.

3.7 Commissioning procedure (parallel module system)

Use this procedure to commission a parallel module, redundant or capacity UPS system.

CAUTION: *Before you carry out this procedure you must be familiar with the Operator Control Panel functions and the rear panel connections (see paragraph 2.4 and paragraph 2.5).*
You should also be familiar with the safety information contained in Chapter 1.

Commissioning a parallel UPS system comprises the following steps:

- Independent commissioning of each UPS module – paragraph 3.7.1.
- Configuring each UPS module for parallel operation – paragraph 3.7.3.
- Parallel system start-up and testing – paragraph 3.7.4.

3.7.1 Independent set-up of each UPS module

Key Point: The selected operating parameters of all the UPS modules must be identical.

Key Point: The output voltage of all modules should be within 1V of each other when operating individually. If a module's voltage is greater than 1V compared with the others you should calibrate its output as described in 3.7.2 before configuring the parallel system functions.

Use the following procedure to set-up each UPS module in turn.

1. Check that the utility supply voltage matches the input voltage range specified on the UPS data plate.
2. Connect the UPS output cables but ensure the load is isolated from the UPS output (load distribution isolator must be open).
3. Connect the battery cable (supplied) between the UPS enclosure and battery enclosure (see Figure 2.7). Note that the connector should be secured in place using the supplied metal bracket.
4. Connect the UPS input power cables to the utility supply (and bypass supply cables to the bypass mains supply if using a split bypass input on the 8 kVA and 10 kVA models) as shown in paragraph 3.5.1.
5. Turn ON the utility/bypass supply, close the input circuit breaker and the battery circuit breaker, located on the rear of the enclosures.
   a) The LCD display will turn on and all of its symbols will illuminate for approximately 3 seconds.
   b) The status leds will all turn on for approximately 3 seconds and then extinguish except for the utility input supply and bypass supply (green) leds, which will remain lit.
   c) The LCD panel will indicate that the battery is on charge and the UPS is oFF.
6. Simultaneously press and hold the ON and DOWN buttons for 3~5 seconds, until a beep is heard, and then release them.
   a) The LCD will display b_on. This indicates that the UPS is now in its set-up mode.

Bypass voltage window

7. Press the DOWN button twice.
   a) The LCD indication will scroll through tnon and end up showing either S_Lo or S_HI. This indicates the applied bypass voltage window.
   S_Lo sets the bypass window to 184~260 VAC and S_HI sets it to 195~260 Vac.
8. Press the UP button to select the wanted bypass voltage window (either S_Lo or S_HI is displayed).

Inverter frequency sync window

9. Press the DOWN button.
   a) The LCD indication will now show either St01 Hz or St03 Hz. This indicates the permitted bypass frequency window to which the UPS inverter will synchronise.
   St01 Hz sets the frequency window to ±1 Hz and St03 Hz sets it to ±3 Hz.
10. Press the UP button to select the wanted bypass frequency sync window.

Inverter output voltage

11. Press the DOWN button.
    a) The LCD indication will now show either o200 V, o208 V, o220 V, o230 V or o240 V.
12. Press the UP button to select the required output voltage.

Input/Output frequency changer mode

The UPS cannot be configured to operate as either a 50/60 Hz or 60/50 Hz frequency changer in a parallel system.

13. Press the DOWN button.
    a) The LCD indication will now show either norL, Eco, c50 Hz or c60 Hz.
14. Press the UP button, if necessary, to ensure the frequency is set to norl (default).

Inverter output fine adjustment

15. Press the DOWN button.
    a) By default, the LCD indication will now show oA 0 %.
    b) If you want to trim the output voltage, press the UP button to cycle through the available options and select the required value – oA 1 %, oA 2 %, oA 3 %, oA- 1 %, oA-2 %, oA-3 %.

Parallel ID Number

Note: *This is a temporary setting necessary to run the UPS as a single module for functional test purposes before configuring it as part of a parallel system. This setting will be changed later.*

16. Press the DOWN button.
    a) For a single module operation the parallel ID number must be set to 1 d01 (default).
    If this is set incorrectly the UPS LCD will display error message Er 17 when it is started.

Parallel Function

Note: *This is a temporary setting necessary to run the UPS as a single module for functional test purposes before configuring it as part of a parallel system. This setting will be changed later.*

17. Press the DOWN button.
    a) For a single module operation the parallel function must be set to P 01 (default).
    If this is set incorrectly the UPS LCD will display error message Er21 when it is started.

Confirm & Save

18. Press the DOWN button.
    a) The LCD indication will now show SAuE.
    b) If you want to double-check all the selected values you can scroll through the above list of parameters by repeatedly pressing the DOWN button and make any necessary further changes.
    c) Once you are satisfied that all the selected values are correct, with SAuE shown on the LCD display press the ENTER button to store the selected values in the UPS memory.
    d) The LCD panel will revert to indicate the battery is on charge and UPS is oFF.

    Note: *Once the configuration has been saved you must turn OFF the UPS and temporarily turn off the input utility supply before you can access the setup mode again using the ON and DOWN buttons. This is a safety measure designed to prevent the UPS operating parameters being changed while it is on-line.*

UPS Module functional check

1. Turn ON the UPS module as described in paragraph 4.1.1.
2. Check all metered parameters to ascertain that the indications are correct (see page 40) and make a note of the UPS output voltage.
3. Leave the UPS running for at least 10 minutes to ensure there is some charge in the battery then isolate the UPS input supply. The UPS should automatically switch to battery operation.
    a) The audible alarm should beep (cancel by pressing the ON button).

b) The utility input led should extinguish on the operator control panel.
c) The LCD mimic should indicate 'On Battery' mode of operation.
d) The LCD metering facility should indicate nominal UPS output voltage.

4. Restore the UPS utility input supply and check that the operator control panel.
   a) The utility input led should illuminate on the operator control panel.
   b) The LCD mimic should indicate 'On Line' mode of operation.
5. Turn off the UPS and isolate its input/bypass supply.

This completes the individual module configuration and functional check. Repeat the above procedure on ALL modules before going to 3.7.3.

3.7.2 Output voltage calibration

Before you connect the UPS modules together to form a parallel system, it is important that you check the output voltage from each module in turn. If a module's output voltage is more than 1V higher/lower than the other modules then its output should be calibrated using the UPS Setting Tool software, as described in paragraph 3.8.4.

3.7.3 Configuring each UPS module for parallel operation

Once the modules have been individually set-up and functionally checked, they must be configured for parallel operation. The position of each module within the parallel system is numerically identified during this set-up, with *module 1* serving as the 'master' module. Before you commence this procedure you should either sketch out or label the modules with their intended identification number as an aide memoir.

Key Point: The modules should be numbered sequentially from 1 to 4 (max). In rack installed systems set the lowest UPS module in the rack to be the 'master' (Module 1): in a tower installation, number the modules from left to right, with the 'master' module (Module 1) on the left.
It is important that the operator knows which is the master module in order to start-up the system correctly.

Carry out the follow procedure on each module in turn, beginning with module 1:

Setting the terminal resistors

1. Ensure that the parallel bus cables are connected in a ring network between the parallel UPS modules.
2. On the UPS modules at either end of the parallel system (i.e. bottom-most/top-most or left-most/right-most), turn ON switch S1 on the rear of the UPS, adjacent to the parallel bus control cables.

	Terminal Resistor Switch (S1) Status			
	UPS 1	UPS2	UPS3	UPS4
2 Modules	ON	ON	–	–
3 Modules	ON	OFF	ON	–
4 Modules	On	OFF	OFF	ON

Figure 3.13 Terminal resistor termination

Setting the module system parameters

3. Turn ON the utility (and bypass) supply and close the UPS input and battery circuit breakers.
   a) The LCD Display will turn on and all of its symbols will illuminate for approximately 3 seconds.
   b) The status leds will all turn on for approximately 3 seconds and then extinguish except for the utility input supply and bypass supply (green) leds, which will remain lit.
   c) The LCD panel will indicate that the battery is on charge and the UPS is oFF.
4. Simultaneously press and hold the ON and DOWN buttons for 3~5 seconds, until you hear a beep, and then release.
   a) The LCD will display b_on. This indicates that the UPS is now in its set-up mode.

Parallel ID Number

5. Press the DOWN button seven times to access the Parallel ID number configuration menu – indicates I dOI by default.
   a) Press the UP button to select the ID number according to the module's assigned position in the parallel system.

Parallel Function

6. Press the DOWN button.
   a) Press the UP button to select P 02 (parallel operation in now enabled).

Confirm & Save

7. Press the DOWN button.
   a) The LCD indication will now show SAuE.
   b) If you want to double-check all the selected values you can scroll through the above list of parameters by repeatedly pressing the DOWN button and make any necessary further changes.
   c) Once you are satisfied that all the selected values are correct, with SAuE shown on the LCD display press the ENTER button to store the selected values in the UPS memory.
   d) The LCD panel will revert to indicate the battery is on charge and UPS is oFF.

   Note: *Once the configuration has been saved you must turn OFF the UPS and temporarily turn off the input utility supply before you can access the setup mode again using the ON and DOWN buttons. This is a safety measure designed to prevent the UPS operating parameters being changed while it is on-line.*

Repeat the above procedure on ALL modules

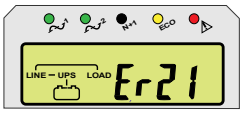
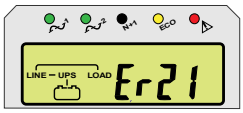
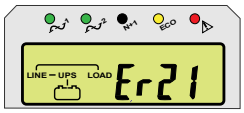
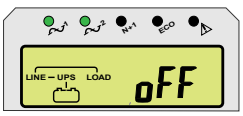
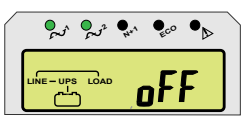
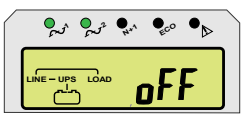
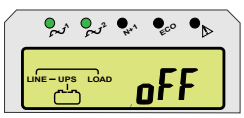
3.7.4 Parallel system testing

Parallel communications test

1. Turn on the utility input supply to all the modules except module 1 – the module set as I dO I – and check that the module indications are as shown in the top row of the table below. Begin with the 2nd, 3rd then 4th module if present.
   a) The LCD on the powered modules should indicate Er2 I.
   b) The LCD status diagram will show the 'On Bypass' mode.
2. Turn on the utility input supply to module 1.
   a) The LCD indications for all modules should change to the standard UPS OFF status, as shown in the bottom row of the table below.
   b) This indicates that the modules' parallel bus is operating normally.

   Note: *If Er21 remains on any module there is a problem with the parallel communication of that module and you should check the parallel bus cable connections.*

WARNING: Do not turn ON any UPS before all modules clear the Er21 test as it could cause unpredictable UPS failure or damage.

	UPS 1	UPS2	UPS3	UPS4
TEST	UTILITY OFF			
TEST OK				

3. Leave the modules in this state for at least 4 hours to fully charge the batteries, then turn on each module in turn following the instructions given in paragraph 5.1.

Troubleshooting other fault codes that might appear

Er 16 Output parameters setting error:
Cause: One or more parameter settings conflict between each module.
Solution: Check the parameter settings are identical in each module as per paragraph 3.7.1.

Er 17 Conflicting ID Number:
Cause (parallel system): Two, or more, modules have the same parallel ID number
Solution (single module): Change the modules' ID settings so that they are not duplicated (paragraph 3.7.3).

Cause (single module): Parallel function is deselected but module ID number is not **id0 1**.
Solution (single module): Change the module ID number to **id0 1** (see page 29).

E 27 Incorrect operating mode selected:
Cause: UPS module is selected to ECO or frequency changer mode.
Solution: Set the UPS operating mode to **norl** (normal).

Er08 DC Bus high level abnormal:
Cause: UPS output voltages not within 1V of each other when run individually.
Solution: Recalibrate UPS output voltages (paragraph 3.7.2).

Cause: Improper installation or parallel communications failure:
Solution: Check parallel settings (paragraph 3.7.3), and cable connections. Then reapply **Er2 1** check to the system.

3.8 UPS Setting Tool

The UPS Setting Tool is a software application that is supplied with the PowerWave 1000. It enables you to select certain basic UPS basic operating functions, calibrate the UPS output voltage, and set-up the module's single/parallel operating parameters to make it suitable for either mode of operation.

The operating parameters can also be set-up from the UPS control panel, as described in paragraph 3.6 for a single module installation, or paragraph 3.7.1 for a parallel module system.

In order to use the UPS Setting Tool you must connect an RS232 serial cable between the UPS COM port and the computer on which the application is installed – with the computer COM port configured as described in paragraph 2.5.1.

***Note:** If you are using the application on a laptop that does not have a serial port, you will require a readily available USB-to-RS232 serial adapter cable.*

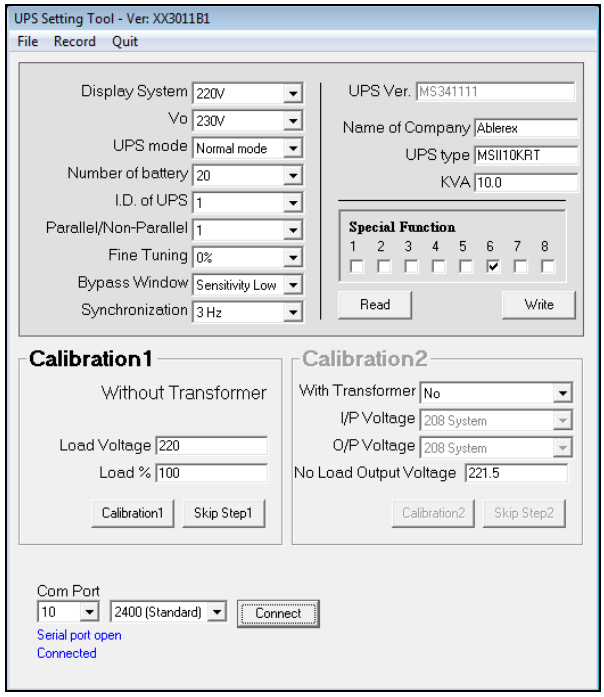
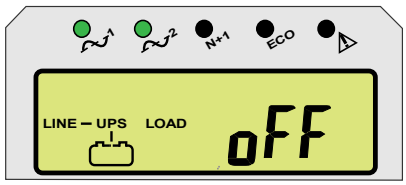
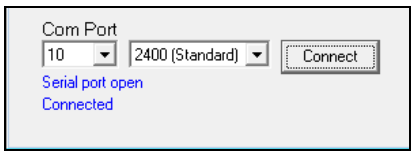


Figure 3.14 UPS Setting tool

3.8.1 Establishing communication

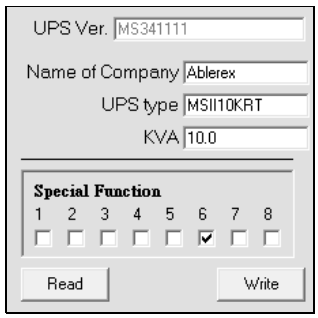


1. Connect the RS232 serial cable between the computer and UPS.
2. Turn ON the UPS input supply but DO NOT press the UPS control panel ON button.
   a) The UPS will run through its start-up self tests and then adopt its oFF status.
   b) Run the UPS Setting Tool application on the computer.
3. Select the appropriate Com Port in the UPS Setting Tool.
   a) A communication link should establish automatically, but press the Connect button if necessary to force the connection.
   b) The Serial port open and Connected status messages should appear.

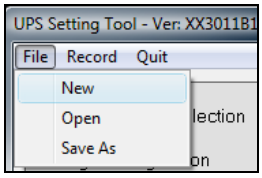


3.8.2 Generating a UPS profile and data file

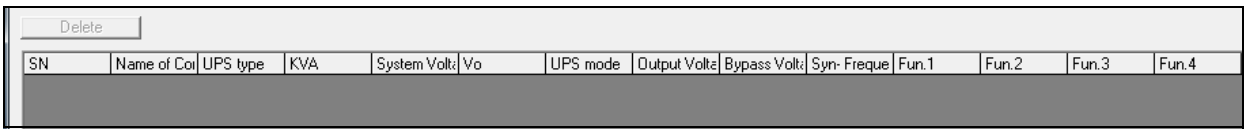
The UPS settings you apply through this tool can be saved to a data file on your computer for later recall. This allows you to observe the changes you've made over time, and provides an easy way to restore a previous configuration profile if required. This procedure shows you how to set up a data file for the specific UPS machine, generate a configuration data record and then access the file to observe the configuration history.



1. In the top right-hand corner of the UPS Setting Tool enter some unique details to identify the connected UPS.
2. Click the Write button to send the identification data to the UPS, where it will be stored in memory.
   a) Click the Yes button in the Writing?? confirmation dialog.
   b) The UPS will beep twice to confirm that it has received the data.
   c) Click OK to clear the Transmit OK dialog.
3. To save the machine profile data to the UPS memory, you must reset the UPS by turning OFF its input supply then turning it back ON again.
4. At any time when the UPS is re-started you can download the data held in the UPS memory by clicking the Read button. This will then populate the UPS Setting Tool fields with the stored values.
5. To set up a new data file, click File>New from the menu bar.



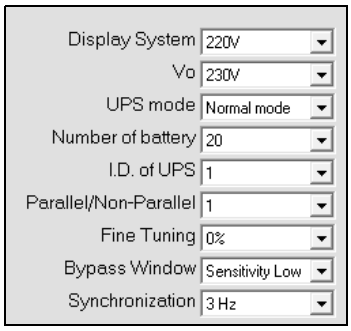
6. Using standard Windows file navigation methods, select the directory in which you want to save the file, enter a filename, and click the Open button to save the file.
7. The file will be save with a .ret filetype.
8. If you open the file (using File>Open from the menu bar) you will see an empty data file, similar to that shown below



9. To add a record for the current configuration data, select Record>Add New from the menu bar.
10. The new record will now be shown in the data file. The Name of Company and UPS type details are shown in the first two fields to identify the UPS machine.
11. In order to associate the data file with the UPS you must once again turn OFF the UPS input supply then turn it back ON again. This will store a reference to the data filename in the UPS memory and enable quick access when you want to open the file in the future.
12. To close the data file click the standard Windows Close button [X] in the top right of the window.

3.8.3 Setting up the basic UPS operating parameters

The UPS Setting Tool allows you to set up several basic UPS operating parameters.



1. Select the required parameters using the drop-down selector boxes (*default):
   a) `Display System` voltage selection – `220V*`, `110V`.
   b) `Vo` (Output voltage selection) – `200V`, `208V`, `220V*`, `230V`, `240V`.
   c) `UPS Mode` – `Normal mode*` (50Hz input/output), `CF50` (50Hz/60Hz input/output), `CF60` (60Hz/50Hz input/output). Note that in a parallel system `Normal mode` is the only permitted selection.
   d) `Number of battery` – number of battery block fitted. If it important that this is set correctly as it affects the battery charging parameters.
   e) `I.D. of UPS` – Set to `01` in a single module installation. In a parallel system this sets the module identity within the parallel chain. The module set at `01` is the *master* module, and the remaining modules must be set to `02`, `03` or `04` respectively.
   f) `Parallel/Non-Parallel` – Set to `01` in a single module installation and `02` in a parallel module system.
   g) Fine Tuning (Output Voltage) – `+3%`, `+2%`, `+1%`, `0%*`, `-1%`, `-2%`, `-3%`.
   h) Bypass Voltage Window – `Sensitivity Low*`, `Sensitivity High`.
   i) Syn-Frequency Window– `3Hz*`, `1Hz`.
2. Once all the parameters have been selected, click the `Write` button to send the data to the UPS.
   a) Click the `Yes` button in the `Writing??` confirmation dialog.
   b) The UPS will beep twice to confirm that it has received the data.
   c) Click `OK` to clear the `Transmit OK` dialog.
3. To apply the changes you must now turn `OFF` the UPS input supply then turn it back `ON` again.

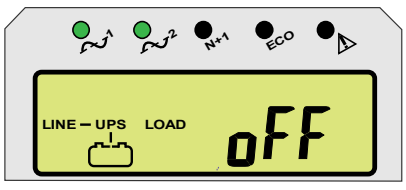
3.8.4 Output voltage calibration

This procedure can be used to calibrate the UPS output voltage and requires access to the UPS output terminals to enable the output voltage to be measured. It can be used to accurately 'trim' the output voltage in a single module installation, or to match the output of all the modules connected to a parallel system.

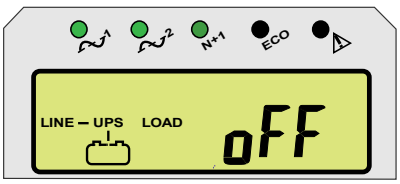
***Note:** In a parallel system this should be carried out on the individual modules before they are connected together.*

Calibration is carried out at 220V irrespective of the desired UPS output voltage.

1. Turn `ON` the utility supply and close the UPS input circuit breaker and battery circuit breaker located on the rear of the UPS/battery enclosures.
   a) The LCD Display will turn on and all of its symbols will illuminate for approximately 3 seconds.
   b) The status leds will all turn on for approximately 3 seconds and then extinguish except for the utility input supply and bypass supply (green) leds, which will remain lit.
   c) The LCD panel will indicate that the battery is on charge and the UPS is `oFF`.

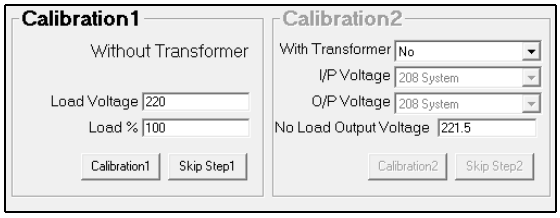


2. Ensure there is no load connected to the module output.
3. Simultaneously press and hold the `ON` and `ENTER` buttons for 3~5 seconds, until a beep is heard, and then release them.
   a) The `N+1` led will illuminate to show that you are in the calibration mode.

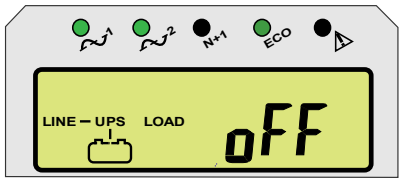


4. Measure the output voltage using an accurate DVM and note the result – if the indication is anything other than 220V it represents an error.
5. Connect the UPS Setting Tool Software application as described in paragraph 3.8.1.

6. On the UPS Setting Tool, click the Read button then click on OK in the confirmation popup.
7. In the Calibration 1 area of the UPS Setting Tool, click Skip Step 1.
8. In the Calibration 2 area ensure that the With Transformer field is set to No.
9. Enter the measured voltage in the No Load Output Voltage field (221.5V in the example shown).



10. Click the Calibration2 button.
    a) The UPS will beep twice to confirm that it has received the data.
    b) The N+1 light will extinguish.
    c) The ECO light will illuminate to confirm that the data has been updated.



11. Turn off the UPS/battery isolators to recycle the UPS.
12. Start the UPS using the normal start procedure and check that the output voltage is now adjusted
13. Quit the UPS Setting Tool software.
14. Turn OFF the utility input power then turn it back ON.
15. Start the UPS following the normal start procedure and check that the UPS output voltage is correct.

3.8.5 Managing the UPS data file

You can open the UPS configuration data file stored on your computer at any time using File>Open from the menu bar, as described in paragraph 3.8.2. When the file is open you can select a record by clicking anywhere in the record line – a selected record is highlighted blue.

Adding a new record to the UPS data file

1. As described above, to add the current configuration to the UPS data file, select Record>Add New on the UPS Setting Tool menu bar.
    a) The new record will be added to the bottom of the data file.

Updating an existing UPS data file record

To update an existing data file record with configuration data displayed in the UPS Setting Tool:

1. Open the UPS data file.
2. Select the particular record that you want to update.
3. Click the Unlock button that appears between the Read and Write buttons on the UPS Setting Tool.
4. Ensure that the UPS Setting Tool contains the required update data.
5. Select Record>Update from the UPS Setting Tool menu bar.
    a) Click the Yes button in the Update?? confirmation dialog.
    b) The UPS data file record will now be updated.

Applying configuration data from an existing record

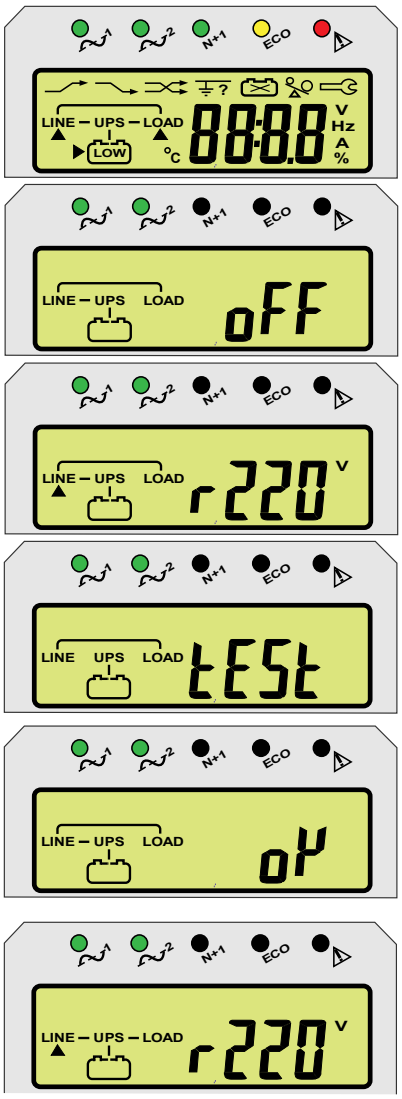
Use this procedure to set up the UPS using data obtained from an existing data file record.

1. Open the UPS data file.
2. Select the data record that you want to apply to the UPS.
3. Click the Unlock button that appears between the Read and Write buttons on the UPS Setting Tool.
4. The UPS Setting Tool data fields will now be populated with data retrieved from the selected data record.
5. Click the Write button to send the data to the UPS.
    a) Click the Yes button in the Writing?? confirmation dialog.
    b) The UPS will beep twice to confirm that it has received the data.
    c) Click OK to clear the Transmit OK dialog.
6. To apply the changes you have made you must now turn OFF the UPS input supply then turn it back ON again.

4 Single Module Operating Procedures

4.1 Single module start-up procedures

4.1.1 Normal start-up (utility available)



1. Turn ON the UPS utility input supply (and bypass supply if separate) then close the input circuit breaker(s) and battery circuit breaker located on the back of the enclosures.
   a) The UPS fans will start.
   b) The UPS control system will boot-up and initially turn on all the leds and LCD symbols for a few seconds.
   c) Once the control system has booted, the ECO*, N+1 and FAULT leds will extinguish, leaving only the utility input and bypass input power leds (green) illuminated.
   d) The LCD mimic will show the 'load on bypass', the battery being charged, and the UPS output status will be shown as oFF.
2. Press and hold the UPS ON button for approximately 3~5 seconds until you hear two beeps, then release it.
   a) The UPS will indicate the bypass voltage.
   b) The audible alarm will sound intermittently but can be silenced by pressing the alarm silence (ON) button.
3. The UPS will run another self tESt for about 4 seconds to check the battery operation.
   a) If the UPS does not complete its self test successfully the LCD will show a FAIL status and the FAULT led will illuminate.
   b) If the self test is successful the LCD will show an OK status for about 5 seconds then change over to display the normal on-line indications**.
   c) The utility input and bypass input power leds (green) remain illuminated.
4. You can now check all the metered input, output and battery parameters to ascertain that the UPS is working correctly (see page 40).

** If the machine is set to operate in the ECO mode the ECO led will be illuminated throughout this procedure.*
*** If the machine is set to operate in the ECO mode the ECO the screen will continue to indicate the on-bypass mode.*

CAUTION: *When turning on the UPS for the first time, or following a long shut down period, leave the unit running for at least eight hours to fully charge the batteries before connecting any critical load, otherwise you may not obtain the specified battery autonomy time if the utility input supply fails.*

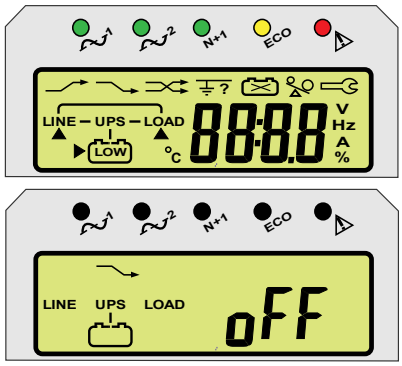
4.1.2 Start-up on battery mode (cold start)

CAUTION: *If you start the UPS using battery power, the battery will begin to discharge and will only provide output power for a short time (depending on load) unless the UPS utility input supply is restored. This facility is primarily intended to be used when testing the UPS.*

In the absence of the utility power supply, the UPS can be started from its internal batteries – sometimes referred to as a "cold start". This is only possible if the batteries are well charged.

Read through this procedure before you attempt to carry it out. In a part of this procedure you have to press the ON button twice within a 15 second period. If you take longer than this, the UPS will not start and you will have to turn it *OFF*, by pressing the *OFF* button, before you can make another attempt to start it.

1. Hold the ON button for approximately 5 seconds until a double beep is heard then momentarily (within 15 seconds) release the button and press it again for approximately 3 seconds until a further beep is heard.



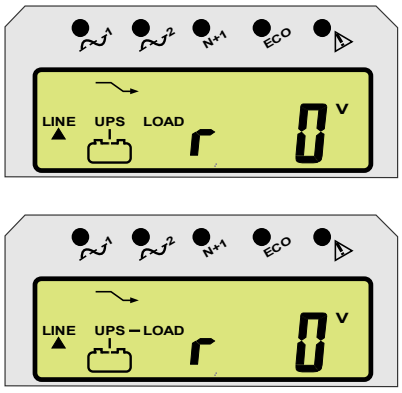
During the first button press

a) The UPS fans will start.

b) The UPS control system will boot-up and initially turn on all the leds and LCD symbols for a few seconds.

c) When control system boot-up has completed, all the leds will turn off, the LCD mimic will display the UPS connected to the battery and the UPS status will be shown as *oFF*.

Following the second button press



a) The LCD display will initially keep the UPS *oFF* screen displayed for a few seconds and will then run a self-test routine for several seconds, during which time the LCD screen will show the input voltage (*r 0* V).

b) The audible alarm will sound intermittently but may be silenced by pressing the alarm silence (ON) button.

c) If the UPS passes its self test routine it will turn on the inverter and begin to provide output power. The LCD mimic display will show that the UPS is operating 'on battery' mode.

2. Check all metered parameters to ascertain that the battery voltage and UPS output indications are correct (see page 40)

4.2 Operator control functions

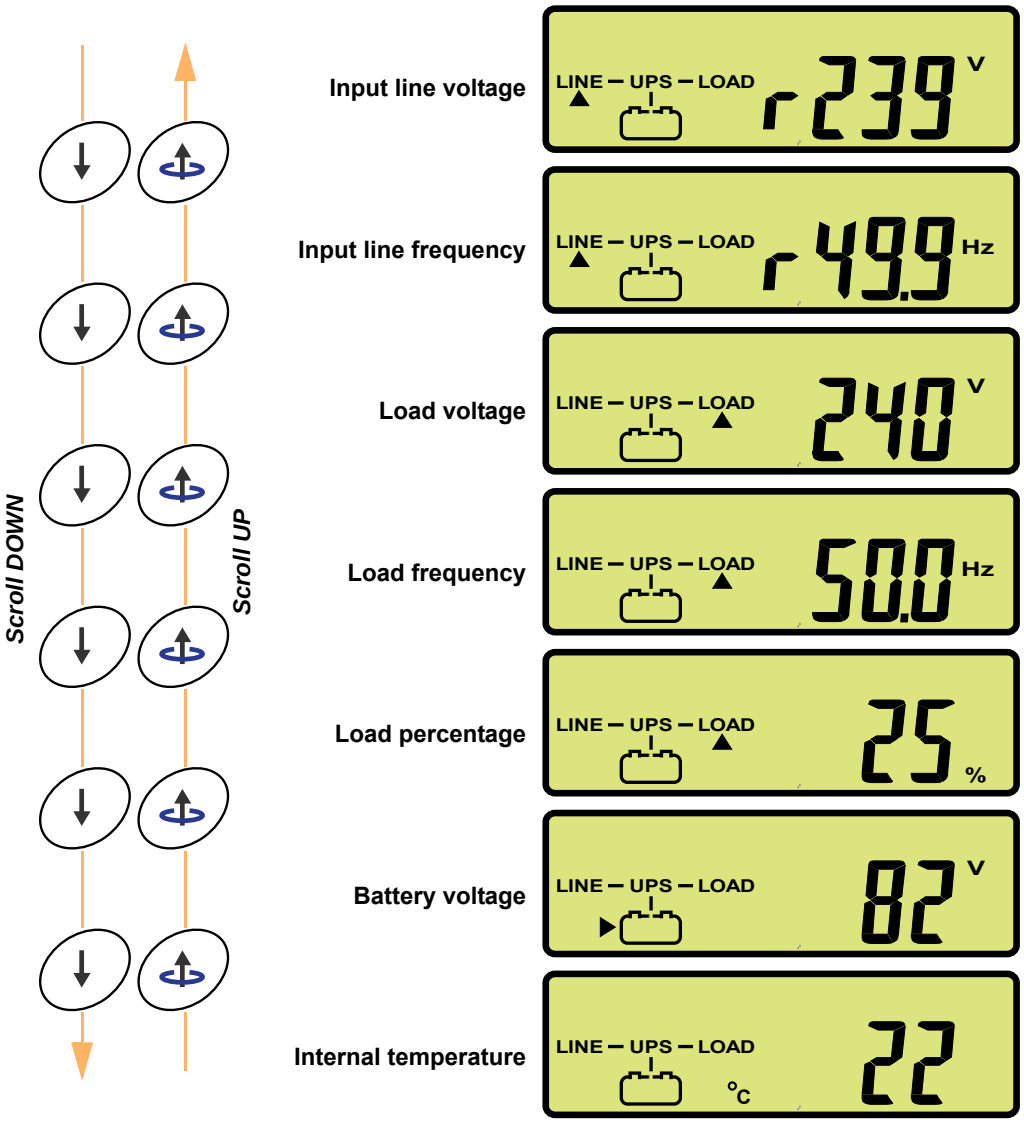
At any time during normal operation of the UPS the operator can:

- Monitor the UPS input supply, output supply, battery and internal temperature using the LCD display.
- Enable or disable the audible alarm.
- Functionally test the battery.

4.2.1 Using the LCD metering function

The LCD metering function can display the input voltage, input frequency, load voltage, load frequency, percentage load, battery voltage and internal temperature. When the UPS is operating, you can scroll through these parameters using the `DOWN` or `UP` button.

Note that the three arrowheads on the LCD mimic diagram identify the source of the meter indication as being either `Input`, `Load` or `Battery`.

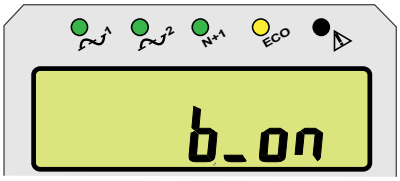


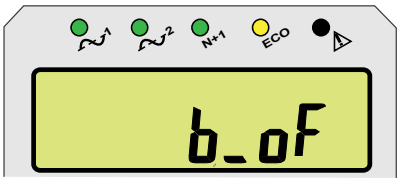
4.2.2 Enable/disable the audible alarm

You can use the following procedure to enable or disable the audible alarm operation. This will not affect the audible beeps associated with pressing the control buttons, which will remain active even if the audible alarm is turned off.

***Note:** If the UPS is powered down and disconnected from its input supply, the audible alarm status will revert to ON b_on (default) when the UPS is next started.*

1. With the UPS on-line, press the FUNCTION button.
   a) The LCD will display either b_on or b_oF. This indicates that the UPS is now in its operator set-up mode and shows the current operational status of the audible alarm.
   b_on = audible alarm enabled – b_oF = audible alarm disabled.
2. Press the UP button to select the wanted audible alarm status.
3. Press the FUNCTION button to activate the selected status and return to the normal LCD Display.



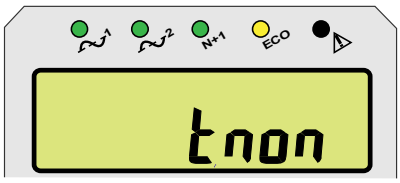


***Note:** If you do not press the FUNCTION button the LCD will revert to its normal display automatically after approximately 10 seconds and the selected audible alarm setting will be activated.*

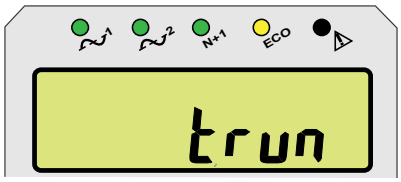
4.2.3 Battery test

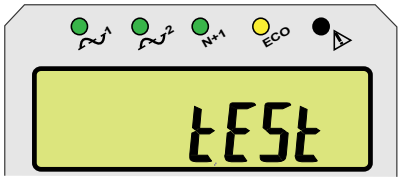
You can carry out a periodic battery test using the following procedure. This test effectively places the UPS in its On-Battery mode for approximately 10 seconds, during which time the control electronics monitors the battery performance.

1. With the UPS turned ON, press the FUNCTION button.
   a) The LCD will display b_on (or b_oF).
2. Press the DOWN button.
   a) The LCD will display tnon.

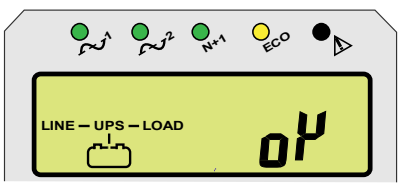


3. Press the UP button
   a) The LCD will momentarily display trun followed by tESt, which will remain on the display while the battery test takes place.





4. When the test is completed the LCD will display this “OK” screen if the battery test was successful, otherwise it will show FAIL.



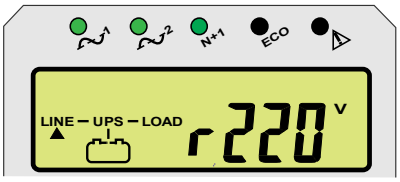
***Note:** If the UPS fails the battery test contact your supplier for technical assistance.*

4.3 Shutdown procedures

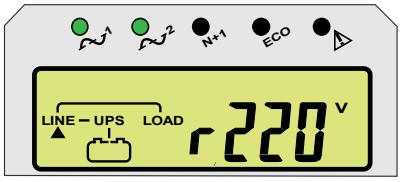
4.3.1 Normal shutdown (with mains available)

This procedure describe the shutdown sequence when turning OFF the UPS when it is operating in its normal 'On Line' mode.

Before you shut down the UPS make sure it is safe to disconnect the critical load power.

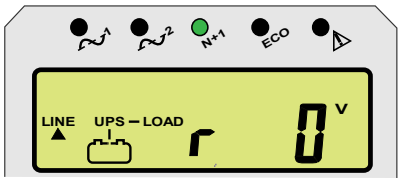


1. Press the OFF button for approximately 3~5 seconds, until you hear two beeps, then release it.
   a) The inverter switches OFF.
   b) The input mains and bypass supply leds will remain lit.
   c) The LCD screen will show the UPS status as oFF.
   d) On the LCD mimic, the load will be shown 'On Bypass' and the battery still connected to the input LINE and on charge.
2. To completely shut down the UPS, disconnect the UPS utility mains supply.
   a) The UPS fans and control panel will remain operative for a few seconds before the unit completely shuts down.
   b) The UPS output will turn OFF and the load will no longer be supplied.

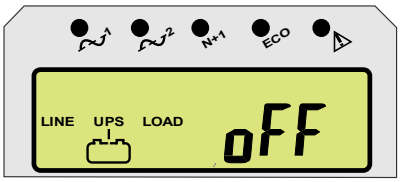


4.3.2 UPS shutdown when on battery

This procedure describe the shutdown sequence when turning OFF the UPS when it is operating in its standby, 'On Battery', mode. You would typically use this procedure during a prolonged utility mains failure if you chose to shutdown the critical load, followed by the UPS, in a controlled manner before the battery reaches the end of its autonomy time.



1. Turn OFF the UPS by pressing the OFF button for approximately 3~5 seconds, until you hear two beeps, then release it.
   a) The two programmable UPS outlet leds will extinguish to indicate the removal of UPS output power.
   b) The LCD screen will show the UPS status as oFF.
   c) On the LCD mimic, the load will be shown disconnected from the UPS.
2. After a few seconds the UPS will completely shut down and all led and display indications will extinguish.



4.4 Manual load transfer between inverter and bypass

Some installations might include an external (maintenance) bypass circuit connected in parallel with the UPS to provide an alternative power source for the load supply. Such installations are designed to enable the UPS to be totally removed or powered down, for troubleshooting, without disrupting the load.

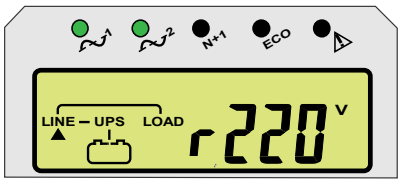
When an external bypass facility is installed, the circuit design does not include a safety interlock to prevent the external bypass circuit from being closed if the UPS is operating on-line – i.e. to prevent the external bypass from back-feeding the UPS inverter and causing it damage. This means that the transfer between the UPS and external bypass is only permitted when the UPS is itself operating on its internal bypass.

The PowerWave 1000 allows the operator to manually switch the load between inverter and bypass so that it can be used within an external bypass environment.

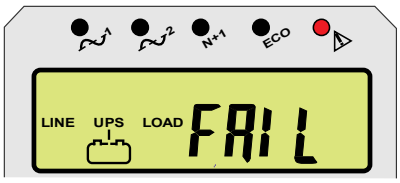
In practice, a variety of external bypass designs are used, so explicit external bypass operating instructions are not provided here. The following instructions refer only to the UPS internal inverter/bypass transfer operation.

4.4.1 Transferring the load from the UPS inverter to the internal bypass

1. Press the OFF button for approximately 3~5 seconds, until you hear a double beep, then release it.
   d) The LCD mimic will show the load connected to the input LINE via the internal bypass.
   e) The batteries are shown still connected to the input LINE and charging (if the charger is still operative).
   f) The audible alarm will sound but can be silenced by pressing the ON button.
   g) All metered parameters can be monitored as per normal.

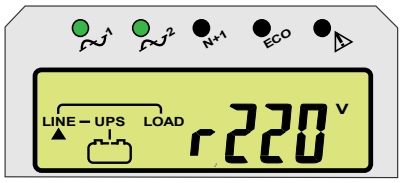


***Note:** If the UPS input mains supply is disconnected when it is operating on bypass, the UPS will not revert to battery power but will instead shut down with a FAIL status indication. The UPS internal electronics will remain powered from the battery and all leds will extinguish apart from the red FAULT led, which will be permanently lit, and the audible alarm will sound continuously.*

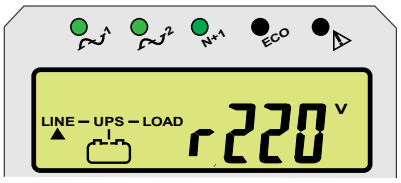


4.4.2 Transferring the load from the static bypass back to the UPS inverter

1. Press the ON button for approximately 3~5 seconds, until you hear a double beep, then release it.
   a) The LCD mimic will show the load connected to the UPS.
   b) The audible alarm will sound but can be silenced by pressing the ON button.



   c) The LCD display will revert to normal (on-line mode) indications.



5 Parallel UPS System Operating Procedures

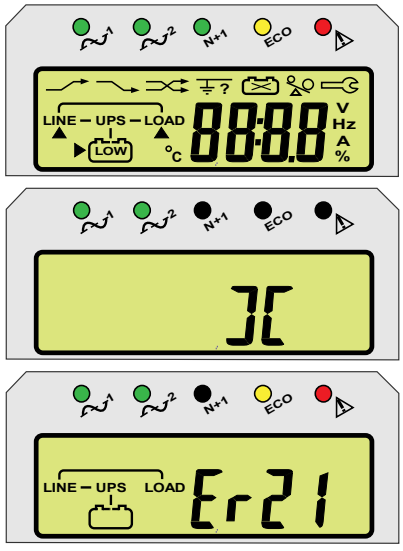
5.1 System start-up procedure

This procedure assumes that the UPS system is being started from a fully shutdown condition and no external (maintenance) bypass facility is connected.

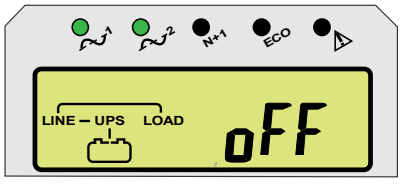
1. Ensure that all the UPS input circuit breakers located on the rear of the UPS are open (for both utility and bypass supplies, where separate).
2. Ensure that all load distribution isolators are open, or the individual load items are turned OFF.
3. Ensure that you can identify module 1 in the parallel system – the module set as *I dO I*. This should be the bottom-most or left-most module (See paragraph 3.7.3).

CAUTION: *The system may malfunction if Module 1 is not the last to be started.*

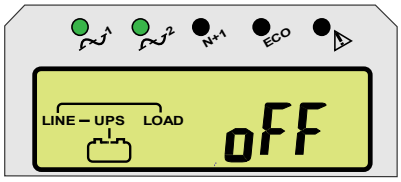
4. On each UPS module in turn **EXCLUDING MODULE 1** –
   Turn ON the UPS utility input supply (and bypass supply if separate) then close the input circuit breaker(s) and battery circuit breaker located on the rear of the enclosures.
   a) The UPS fans will start.
   b) The control system will boot-up and initially turn on all the leds and LCD symbols for a few seconds.
   c) Once the control system has booted, the ECO and N+1 leds will extinguish.
   d) The UPS will then carry out some internal self tests.
   e) When the self tests are completed the LCD screen will display an *Er21* error code.



5. ON MODULE 1 –
   Turn **ON** the UPS utility input supply (and bypass supply if separate) then close the input circuit breaker(s) and battery circuit breaker located on the rear of the enclosures.
6. Module 1 will boot up in exactly the same manner as described above for the other models, but at the end of its self checks:
   a) It will turn on its static bypass supply and the LCD mimic will indicate the 'on bypass' status and the battery being charged.
   b) The UPS output status will be shown as *oFF*.



7. On ALL modules, check that the Er21 error has disappeared from the LCD screen and they now indicate the 'on-bypass' status.

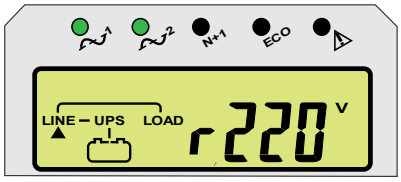


   a) If any module still shows Er21 it indicates that it has a problem concerning the parallel communication bus which must be rectified before the UPS system can be turned on.

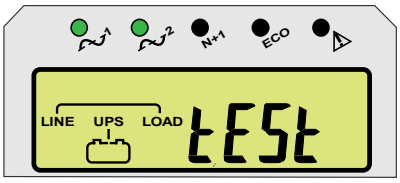
8. If ALL the modules are energised and operating in the 'on-bypass' mode, you can now turn on the load by closing the external load isolators or switching on the individual load items.

   Note: *The load will not be receiving protected power until the UPS system has been fully turned on.*

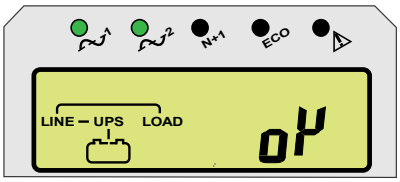
9. On each UPS module in turn (LEAVE MODULE 1 UNTIL LAST) –
   Press and hold the UPS ON button for approximately 3~5 seconds until you hear two beeps, then release it.



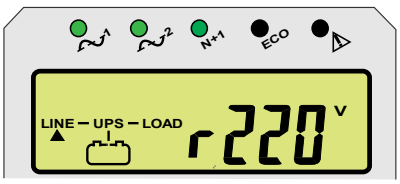
   a) The UPS will indicate the bypass voltage.
   b) The audible alarm will sound intermittently but can be silenced by pressing the alarm silence (ON) button.
   c) The UPS will run another tESt for about 4 seconds to check the battery operation.



   d) If the UPS does not complete its battery test successfully the LCD will show a FAIL status and the FAULT led will illuminate. If the self test is successful the LCD will show an OK status for about 5 seconds.



10. When the ON button has been pressed on all module and they have successfully passed their battery checks, they will carry out some further 'parallel operation' checks and, once these final tests are passed (typically 5~10 seconds), the modules will then simultaneously transfer their output from the static bypass to the inverter.



   a) The LCD mimic will now show the 'on-line' status with the battery being charged.
   b) The LCD meter will indicate the utility input voltage.
   c) The utility input and bypass input power leds will remain illuminated (green), and the N+1 led will be fully illuminated if there is system redundancy.

11. You can now check all the metered input, output and battery parameters to ascertain that the UPS system is working correctly (see page 40).

CAUTION: *Congratulations. Your load is now being provided with consistent and backed-up power.*

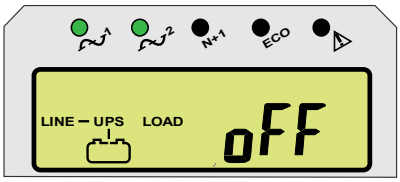
CAUTION: *When turning on the UPS for the first time, or following a long shut down period, leave the unit running for at least eight hours to fully charge the batteries before connecting any mission-critical load, otherwise you may not obtain the specified battery autonomy time if the utility input supply fails.*

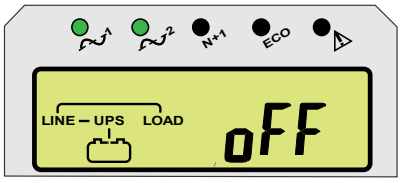
5.2 Shutdown procedure

This procedure assumes that the UPS system is to be totally shut down from a fully 'On-line' condition and no external (maintenance) bypass facility is connected.

CAUTION: *Before you shut down the UPS system you should first check with the load user that it is operationally safe to disconnect the critical low power.*

1. Turn off the load by opening the external load isolators or switching off the individual load items.
2. On each UPS module in turn, press the OFF button for approximately 3~5 seconds, until you hear two beeps, then release it.
   a) The input mains and bypass supply leds will remain lit.
   b) The LCD screen will show the UPS status as oFF.
   c) On the LCD mimic, the load will be shown disconnected from the UPS but the battery still connected to the input LINE and on charge (top illustration).
   d) Continue switching OFF the other modules.
   e) When ALL the modules have been turned OFF they will simultaneously switch to the 'On-bypass' mode and the LCD will be as shown in the lower illustration.





3. To completely shut down the UPS:
   a) Turn OFF the UPS utility supply (and bypass supply if separate).
   b) Open the input circuit breaker(s) located on the back of the UPS.
   c) Open the battery isolator on the back of the battery enclosure.
4. The UPS fans and control panel will remain operative for a few seconds before the unit completely shuts down.

5.3 Manual load transfer between inverter and bypass

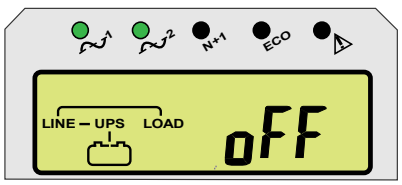
Some installations might include an external (maintenance) bypass circuit connected in parallel with the UPS to provide an alternative power source for the load supply. Such installations are designed to enable the UPS system to be totally powered down without disrupting the load – for example, for troubleshooting or repair.

To prevent the external bypass from back-feeding the UPS inverter and causing it damage, the transfer between the UPS and external bypass is only permitted if the UPS is itself operating on its internal static bypass.

Note: *In practice, a variety of external bypass designs are used, so explicit external bypass operating instructions are not provided here. The following instructions refer only to the UPS internal inverter/bypass transfer operation.*

5.3.1 Transferring the load from the UPS inverter to the internal bypass

1. Turn **OFF** ALL the UPS modules in turn by pressing their **OFF** button.
2. As the modules are turned off, the load will be transferred to the internal static bypass line ('on-bypass' mode) in ALL modules when the number modules remaining on line defeats the system's redundancy (depending on load).
   On ALL modules:
   a) The input mains and bypass supply leds will remain illuminated but the N+1 led will extinguish.
   b) The LCD screen will show the UPS status as oFF.
   c) On the LCD mimic, the load will be shown disconnected from the UPS but the battery still connected to the input LINE and on charge.
   d) All metered parameters can be monitored as per normal.



***Note:** If the UPS bypass mains supply is disconnected when it is operating on bypass, the UPS will not revert to battery power but will instead shut down with a* FAIL *status indication. The UPS internal electronics will remain powered from the battery and all leds will extinguish apart from the red* FAULT *led, which will be permanently lit, and the audible alarm will sound continuously.*

5.3.2 Transferring the load from the static bypass back to the UPS inverter

To transfer the load from the internal static bypass supply ('On-bypass' mode) to normal operation ('On-line' mode), follow the normal start-up procedure in paragraph 5.1, beginning at step 8.

6 Maintenance

6.1 Battery replacement

The UPS batteries are fitted in plastic-covered packs which are accessible from the front of the enclosure and can be replaced without shutting down the UPS.

CAUTION: *If battery replacement is necessary it should undertaken by a trained engineer.*

1. .Using a small screwdriver as a lever, carefully remove the two press-fit plastic covers from the left hand end of the UPS front panel. This will expose two front panel securing screws.
2. Remove the two front panel securing screws using a Phillips screwdriver.
3. Carefully pull the fascia away from the front panel to expose the battery packs.
4. Cut any cable ties that are holding the battery cables in place.
5. Disconnect the battery connector(s) and carefully withdraw the battery pack(s).

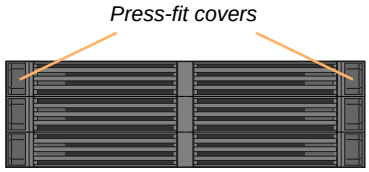


Figure 6.1

Use the above procedure in reverse order to fit the battery pack(s).

7 Troubleshooting

7.1 Introduction

If a fault occurs, due to either a UPS internal malfunction or severe overload condition, the UPS will shut down and 'lock-out', and must be reset by the operator, by turning the input power off and on, in order to bring it back into operation. The red FAULT led will illuminate on the control panel and the LCD will indicate an error code (see below).

Depending on the cause of the fault, the UPS may either shut down entirely (top illustration) or transfer the load to the internal bypass line (lower illustration).

In a parallel system, if one module shuts down due to a fault condition the remaining modules will continue to operate and maintain the supply to the load if the system redundancy permits. If the system redundancy is exceeded, then ALL the remaining modules will transfer to 'on-bypass' operation (lower illustration).

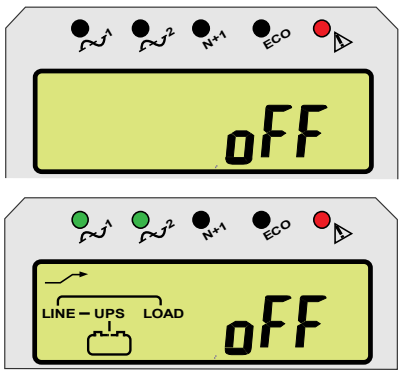


Figure 7.1 UPS Fault screens

In a single module installation, if the UPS shuts down due to a fault condition and is able to transfer the load to the static bypass then it will do so, to maintain the load supply (lower illustration).

7.2 Error codes

In general, under fault conditions the red FAULT led will illuminate and an audible warning will be given. Many faults can be identified by briefly pressing the OFF button, which then displays a fault code on the LCD message area.

Key Point: If you press the OFF button for longer than five seconds the UPS will shut-down.

Error Codes			
Er05	Weak or faulty battery	Er 16	Parallel system setup error
Er06	Output short-circuited	Er 17	Module ID number error
Er07	EPO Operated	Er 18	EEPROM Data error
Er08	DC bus voltage high	Er21	Parallel system communications error.
Er 10	Inverter overload	Er24	Low input voltage (<85-170V) or disconnected battery
Er 11	UPS Over temperature	Er27	Parallel system not set to NORMAL mode
Er 12	UPS output overload	Er28	Bypass overload
Er 14	Fan failure	Er31	Incorrect EEPROM jumper setting
Er 15	Incorrect mode entry		

7.2.1 Audible alarm interpretation aids

Audible Alarm (beeps)	Interpretation
Continuous beep	UPS Faulty, Inverter shutdown. All functions inhibited
Single beep every 2 secs.	UPS Faulty, load is still supplied via inverter or bypass.
Single beep every sec.	UPS On-Battery mode
Quick and short successive beeps	Battery low
Two quick and short beeps	Confirm / RS232 port receiving.
One quick and short beep	Service Mode
Two quick and short beeps, repeating every two secs.	UPS Initial start-up with self test.

7.3 Troubleshooting a fault condition

If the UPS develops a fault during operation (FAULT led illuminated), you should check the error codes listed below for appropriate solutions. Should the problem persist, please contact your local dealer for assistance.

LCD Error Code	Possible Solution
LOW Er05 Er24	**Battery problem:** 1. Check that the battery connections have been made correctly. 2. Measure the battery voltage to ensure it is charged and in good condition. Recharge battery for 8 hours if necessary. 3. Simulate a utility supply outage to establish that UPS is able to provide DC back-up. 4. Contact your local dealer right away if you can find no problem with the above.
Er06 Er 10 Er 12 Er28	**Overload:** 1. Disconnect any non critical loads from the UPS output until the overload ceases. 2. Check the condition of the output cables and connectors to determine that they are undamaged and the insulation is sound. Replace the output cables if necessary. 3. Contact your local dealer right away if you can find no problem with the above.
Er 11	**UPS Over temperature:** 1. Remove any objects obstructing the ventilation louvers. 2. Check to ensure that the cooling fans are working properly (see also Er 14), and contact your local dealer to replace the fans if necessary. 3. Contact your local dealer right away if you can find no problem with the above.
Er 14	**Fan error:** 1. Verify if the ventilating fans are functioning properly. Do not attempt to replace the fans by yourself. 2. Contact your local dealer for fan replacement.
Er 15 Er27	**Incorrect mode selected:** 1. UPS must be selected to operate in NORMAL mode. 2. Select correct operating mode then turn OFF the UPS to reset it.
Er 16 Er27	**Parallel module set-up error:** 1. Check that all set-up parameters apart from the module ID number are identical in all parallel modules. 2. Select correct operating mode then turn OFF the UPS to reset it.
Er21	**Parallel communication error:** 1. Check that all RJ-45 cables are connected properly. 2. Check that only one module is assigned an ID=1. 3. If occurs during system start-up check that it resets when module 1 is powered up (last).
⏚?	**Site wiring/earth fault:** 1. Check that the utility AC source 'L' & 'N' have been wired correctly. 2. Check that the earth/ neutral voltage has exceeded the limits specified in chapter 9. 3. Contact your local dealer right away if you can find no problem with the above.
Other error codes	For all other error codes, contact your local dealer for technical assistance.

7.4 Troubleshooting an operational problem.

Symptom	Possible Solution
UPS fails to provide battery back-up, or its back-up time is shorter than its specified performance.	1. Ensure that the circuit breaker on the back of the battery enclosure is closed. 2. Charge the battery for eight hours. 3. Recheck, and if the back-up time remains unsatisfactory after 8 hours of charging, please contact your local dealer for battery replacement.
UPS operation appears to be normal but there is no output to load.	1. Check that all output power cables are connected correctly, and all output isolators are closed. 2. If the problem persists, consult your local dealer for technical assistance.
The UPS switches to battery mode then back to on-line mode, when the connected device is turned on. Or, the UPS switches back and forth between battery and on-line mode.	1. Check for a faulty UPS input cable or utility supply wall receptacle and replace/repair any faulty item found. 2. If the problem persists, consult your local dealer for technical assistance.
Strange noise and/or odour emitted by UPS	1. Immediately shut down the UPS System. 2. Disconnect the UPS input power and call for service.

7.5 UPS Fault handling

7.5.1 UPS Overload

Items of electronics and IT equipment can generate an inrush current when they switch on.

To prevent severe inverter damage caused by inrush currents, the UPS is equipped with an electronic overload protection feature which switches the load to the bypass line within 1 minute if the UPS load rises to between 105% – 120% of its rated capacity. As inrush currents are normally short-lived, once the current being drawn from the bypass falls below <105%, the UPS will switch back to inverter mode automatically.

Note that if the UPS is overloaded by >150% its inverter will shut down immediately.

The bypass line is also equipped with overload protection. Its overload capacity/time characteristics are illustrated in the table below.

Load (%)	110-120	121-130	131-135	136-145	146-148	149-157	158-176	177-187	188<
Delay Time (sec)	250	125	50	20	5	2	1	0.32	0.16

7.5.2 Output short circuit

Output load short circuit when the output supply is via inverter

If output load is short-circuited while it is being supplied via the inverter:

a) The inverter is shutdown immediately and stop the supply to the load.
b) The FAULT led will illuminate up and the audible alarm will beep continuously.
c) The UPS will not switch on automatically after the short-circuit condition is eliminated. It has to be re-started manually (see paragraph 4.1.1).

Output short-circuit when the output supply via the bypass line

If the output load is short-circuited in bypass mode:

a) The utility fuse/breaker will be activated (open-circuited) to prevent the output load from damage.
b) You must replace the fuse with a fuse of the same rating after the cause of the short-circuit condition has been rectified.

7.5.3 Inverter/internal over-temperature

If the UPS experiences an internal over-temperature when the utility supply is normal it will transfer the load to the bypass line, and switch back to inverter mode when the over-temperature situation has been eliminated.

If over temperature occurs when the utility supply is abnormal:

a) The audible alarm will beep continuously.
b) The FAULT led will illuminate.
c) The UPS will cut off the load supply.

7.5.4 Inverter over-current and output voltage out of tolerance

If the UPS develops a fault and its inverter delivers an over-current and out-of-tolerance voltage:

a) The UPS will transfer the load to the bypass line as long as the utility supply is normal.
b) The UTILITY led, BYPASS led and FAULT led will illuminate.

If these fault conditions occur when the utility supply is abnormal:

a) The UPS will cut off the supply to its outlets and shut down.
b) The FAULT led will illuminate.

8 Options

8.1 The importance of UPS management

The utility supply is inevitably unreliable every now and then; and assuring continuous power to all the facilities connected to it can be a difficult task. The situation is further complicated if worldwide systems are managed via a Local Area Network (LAN) or Wide Area Network (WAN).

However, by using the PowerWave 1000 UPS system in conjunction with purpose-designed network management tools, a systems administrator can take measures to back-up data and prevent system errors or data loss even in the event of a relatively long utility supply outage. In the case of an abnormal utility supply, suitable UPS management software will also enable a system administrator to monitor all concerned networks from a central point and identify bottlenecks at an early stage.

In spite of extensive system monitoring, if an administrator fails to intervene in a timely manner serious damage can still occur. It is important therefore that the installed UPS software will react automatically in such a case and shut down the supplied system in a safe and controlled manner.

Uninterruptible Power Supplies Ltd considers it important to have a complete solution for its UPS systems, and offers its customers a number of remote control and monitoring tools to provide optimum protection.

8.2 WAVEMON shutdown and management software

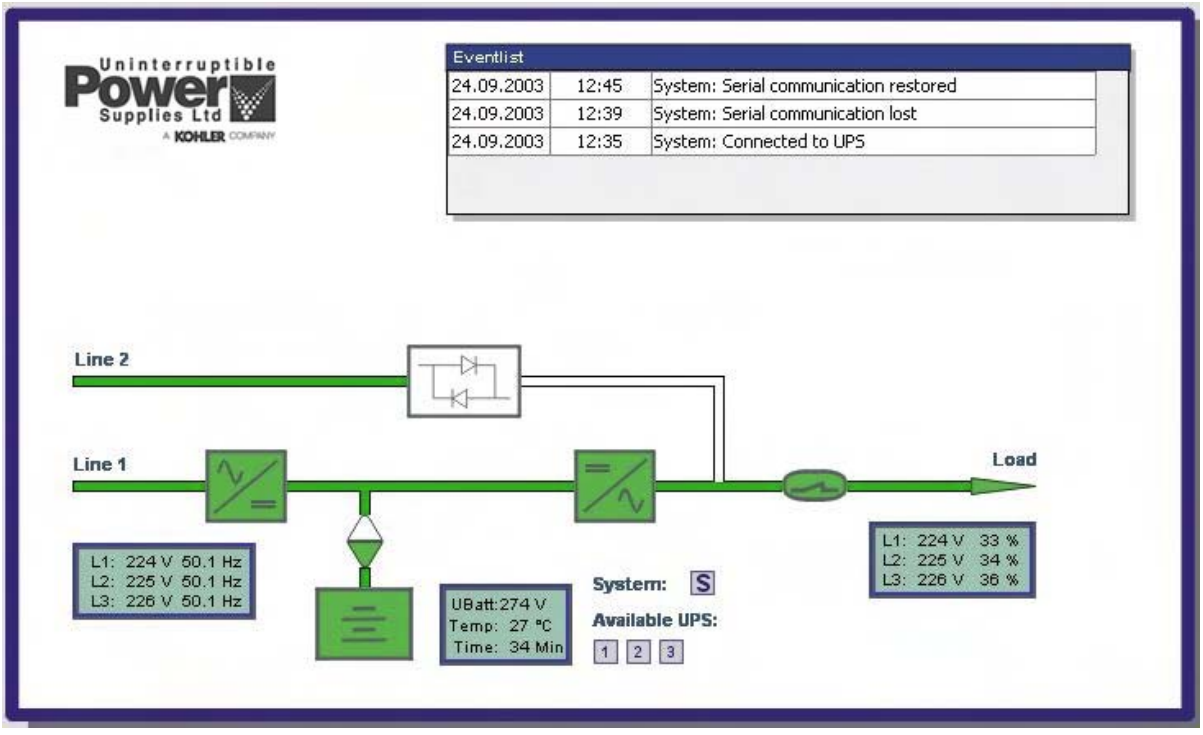


Figure 8.1 WAVEMON Monitoring screen

WAVEMON is a software application designed to operate with many of the systems supplied by Uninterruptible Power Supplies Ltd and features both UPS monitoring and automatic UPS/server shutdown facilities. It comprises a bespoke software package which is installed on a local PC and communicates with the UPS via USB or a standard RS232 serial cable of up to 15m in length.

Uninterruptible Power Supplies Ltd offer suitable monitoring software with SNMP functionality for NetWare, OS/2, all Windows NT systems on INTEL and ALPHA network platforms.

The main features of WAVEMON are:

- On-screen autonomy time/battery time countdown.
- On-screen server log-off and shutdown procedure.
- Time and date stamp event log.
- Extensive logging of all UPS activity and power quality data.
- Permits alarm warnings to be monitored remotely via email.
- Scheduled UPS service mode and other systems status.
- Graphical user interface for Windows-compatible platforms.
- Automatic unattended local shutdown.
- Special modules for MS-Office software to close and save open documents.
- Compatible with all optional modules like UPSDIALER, SNMP adaptors, temperature sensors, etc.

8.2.1 Functional description

WAVEMON is a client/server software application for networks and local workstations. In general, it consists of two parts: the server module of the UPS management software is *UPSMAN* which communicates with the UPS via an RS232/USB interface. Running as a background application, *UPSMAN* collects and interprets the messages received from the UPS and places them at the disposal of the client module *UPSMON,* as well as any connected SNMP-based instrumentation and control system.

If *UPSMAN* detects voltage variations or a power failure, it can execute various ‘system event’ routines, by means of which, for example, the server is switched off or a warning is sent to the connected users. These ‘system event’ routines are a part of the management software and can be configured in accordance with local application requirements.

The software of your PowerWave 1000 UPS unit can be integrated into a network in two ways:

1. By the server which is supplied by the UPS itself and has been integrated into the network. In most cases this server is used as a sub-agent and you only need the WAVEMON software (without an SNMP adapter). You will also need to establish an RS232/USB connection between the UPS and computer/server.
2. In many cases the use of what is referred to as an ‘SNMP adapter’ is to be preferred in order to integrate the UPS into the network. In this case up to 50 computers can be shut down in one RCCMD environment. RCCMD (remote console command) is an additional software module that is used in order to execute a command (typically a shutdown command) in a remote system.

8.2.2 Licensing

A licence is issued with every software serial number for use of what is known as the ‘UPS service’ on a single server in connection with one UPS and an unlimited number of connected WINDOWS workstations. For operation with two or more servers, a further licence is required for each additional server. In this case it is of no importance whether the UPS service on these servers is active or whether the server was stopped by a remote UPS service. The same applies to the use of RCCMD with the ‘remote send/receive’ modules for ‘multi-server shutdown’ under NT, UNIX and other operating systems.

The service programs are generally supplied as single licences. In order to use a single CD-ROM for several ‘multi-server shut-down’ units you must acquire additional licence codes.

8.3 SNMP adapters

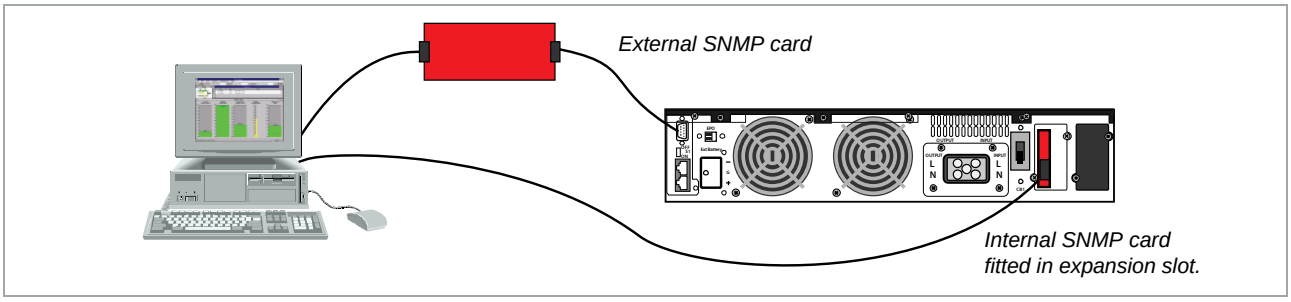


Figure 8.2 SNMP Adapters

Simple Network Management Protocol (SNMP) is a world-wide, standardised communication protocol that can be used to monitor any network-connected device via a simple control language, and display the results in a browser-based application.

The UPS management software can make your UPS data available in this SNMP format thanks to the software agent built in to the SNMP adapter. Uninterruptible Power Supplies Ltd offer software with SNMP functionality for Novell, OS/2, and Windows that run both on INTEL and on ALPHA, DEC VMS and Apple.

Two models of SNMP adapters are available for use with the PowerWave 1000, both of which share the same functionality. An internal SNMP card can be fitted into the communications card expansion slot located on the UPS enclosure rear panel and communicates with the UPS via a serial interface. An optional external SNMP adapter can be used, located remotely and connected to the UPS via its RS232 port.

The SNMP adapter can be configured via Telnet, http (browser) or serial connection. For normal operation, at least one Ethernet network connection is necessary. Further details are provided in the manual that is supplied on the WAVEMON installation CD.

RCCMD

RCCMD (Remote Console Command Module) for 'multi-server shutdown', is an independent software module intended for transmitting and receiving 'remote commands'. The new version RCCMD2 is, similar to WAVEMON, available for the most widespread operating systems. Using the 'RCCMD send' function, the SNMP adapter can send status messages to connected users or initiate automatic shutdown throughout the whole network. Our SNMP adapters are fully compatible with RCCMD.

8.4 AS400 (dry contact) card

The DCE dry contact card provides volt-free outputs that can be used for the automatic and orderly shutdown of servers (AS400) or used as control inputs to building management systems.

The signal descriptions of the 10 pins of the dry contact card are shown below. Note that all pins except Pins 9 and 10 (which are isolated) are link-selectable to be either short-circuited or open-circuited to the common Pin 8 when the monitored parameter is 'active'.

Figure 8.3 DCE Dry contact card

The pin assignment of the 10-pin terminals are:

1	UPS on bypass mode	6	Battery weak or faulty
2	Utility input abnormal	7	UPS fault Alarm
3	Utility input normal	8	Common
4	Inverter On	9	Shutdown UPS positive (+) signal
5	Battery Low	10	Shutdown UPS negative (-) signal

To shut down the UPS, you must connect a DC voltage of 5.5V~25V between pin 9 (+) and pin 10 (-).

8.5 USE (USB) card

This card can be installed in the Option Slot located on the rear of the UPS to facilitate an alternative USB interface.

The USB configuration detail is described in paragraph 2.5.

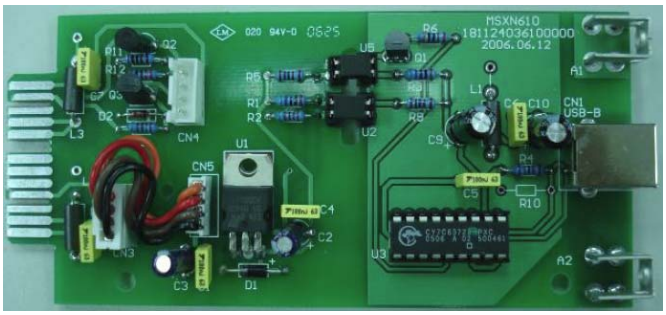


Figure 8.4 USB Option card

8.6 R2E (second RS-232) card

This card can be installed in the Option Slot located on the rear of the UPS to facilitate an alternative RS-232 interface.

The RS-232 configuration detail is described in paragraph 2.5.

Figure 8.5 RS232 Option card

9 Specification

	PW1000/4.5	PW1000/6.0	PW1000/8.0	PW1000/10.0
Input :				
Nominal voltage	Single phase 160 VAC- 288 VAC			1ϕ, 160- 288VAC, 3ϕ, 277 - 485VAC
Frequency	50 - 65 Hz, ±5 Hz (auto sensing)			
Phase	Single			Single or three
Power factor	Up to 0.99 at full rated linear load			
Input current total harmonic distortion (THDi)	< 6% at 100% linear load			
Output :				
Voltage	200/208/220/230/240 VAC (selectable) *(208/120V optional)*			
Voltage adjustment	±0%, ±1%, ±2%, ±3% (selected by software)			
Voltage regulation	±2%			
Capacity	4500VA/4050W	6000VA/5400W	8000VA/7200W	10000VA/9000W
Power factor	0.9 Lagging			
Wave form	Sine wave, THD<3% (linear load)			
Frequency stability	±0.2% (unless synchronised to line)			
Synchronisation window	±1 Hz, ±3Hz (selectable via software)			
Transfer time Inverter-Bypass (typical)	0 ms			
Crest factor	3:1			
DC Start	Yes			
Efficiency :				
Efficiency (AC to AC Normal)	91%			
Efficiency (AC to AC ECO mode)	Up to 92%		Up to 93%	Up to 96%
Protection :				
Overload capability (AC mode & Backup mode)	Up to 105% load = normal operation, from 106%...120% load = switching to bypass after 1 min. from 121%...150% load = switching to bypass after 10 Sec from 151% load = switching to bypass immediately			

	PW1000/4.5	PW1000/6.0	PW1000/8.0	PW1000/10.0
Overload capability (bypass operation)	<105% load continuously >106%...120% load for 250sec shut down >121%...130% load for 125sec shut down >131%...135% load for 50sec shut down >136%...145% load for 20sec shut down >146%...148% load for 5sec shut down >149%...157% load for 2sec shut down >158%...176% load for 1sec shut down >177%...187% load for 0.32sec shut down >188% load for 0.16sec shut down			
Short circuit handling	In normal mode: output breaker / electronic fuse In battery mode: output breaker / electronic fuse In bypass mode: input fuse			
Over temperature (AC mode)	Switch to bypass			
Over temperature (Bypass mode)	Immediate UPS shutdown			
Battery :				
Battery type	VRLA, leak-proof (lead-acid)			
Battery quantity (12V)	20 x 7.0 Ah		20 x 9.0 Ah	
Autonomy time (full load)	≥7 min	≥4 min	≥4 min	≥2 min
Charging time to 90% load	4 hours			6 hours
External battery connection	Plug & play (cable provided)			
Life cycle (typical)	Up to 5 years, at max. 20°C ambient temperature			
Display Panel :				
Status on LED and LCD	On-line mode, On-battery mode, ECO mode, Input supply, Bypass supply, Battery low, Battery bad/disconnect, Overload, Transfer with interruption, UPS fault			
LCD Metering display	Input voltage, Input frequency, Output voltage, Output frequency, Load percentage, Battery voltage, Internal temperature			
LCD Status display	Module mimic showing operating status, fault and diagnostic indications Software configuration menu indications			
Self diagnosis	Upon power-on, Front panel setting and software control, 24-hour routing checking			
Operator buttons (keys)	UPS ON/OFF, Alarm test/silence, Meter selection, Software menu selection			
Audible Alarms :				
Line failure (‘on-battery’ mode)	Audible beep every 1.5 seconds			
Battery low	Audible beep every 0.2 seconds			
Overload	Audible beep every 3.0 seconds			
Fault transfer to bypass	Will sound permanently (or every 3 seconds)			
System fault condition	Will sound permanently (or every 3 seconds)			
Communications Options :				
In-built computer interfaces	1 x RS-232, 1 x USB			
Optional plug-in interface cards	SNMP-Card, Modbus-Card, Relay-Card			
Compatible operating systems	Windows, Unix (and derivatives), OS/2, Novell, AppleOS			

	PW1000/4.5	PW1000/6.0	PW1000/8.0	PW1000/10.0
Hardware Options :				
Accessories	External bypass External battery module Output distribution 19 in rack mounting rails			
Environmental :				
Temperature (°C)	Operating: 0-40 / Storage: 0-45			
Maximum altitude above sea level	0-2000m up to 40ºC / 3000m up to 35ºC			
Humidity	0%...90%, non-condensing			
Sound level	50 dBA (@ 1m)			
Heat dissipation (approx)	450W	500W	600W	700
Mechanical Data :				
Dimensions (WxHxD) mm	440x88x680		440x132x680	
19" rack mounting space	(2U+3U)x680		(3U+3U)x680	
Weight (net)	24 kg		26 kg	
Input / output power connections	Hard wired to terminal block			
Other connectors	1 x USB, 1 x RS232, 1 x 2-pole EPO-Connector 1 x Interface Slot			
Standards :				
Safety	EN 62040-1-1, IEC 60950-1			
EMV Compatibility	EN 62040-2, EN 61000-3-2, EN61000-3-3, FCC-A			
Performance features	IEC/EN 62040-3			
Product certification	CE, FCC (additional versions on request)			
Protection class	IP 20			
Manufacturing standards	ISO 9001.2000			